Mining CONGRESS JOURNAL

AMERICAN MINING CONGRESS

MAY
1954

New use of modern equipment doubles profitable stripping depth — improves grade of coal

BACK in 1940, the Avon Coal Company found it was not profitable to strip more than 25 feet of overburden to reach a seam of coal. For this reason, shaft mining was used exclusively in their Minto, New Brunswick coal field.

But, today, with the help of a fleet of modern Allis-Chalmers tractors, the company now can strip up to 60 feet of overburden and then mine a 20-inch seam of coal at a profit. What's more, this new method and postwar equipment has resulted in the production of a far better grade of coal . . . has opened many new markets for Minto coal.

Ask your Allis-Chalmers dealer how modern earth-moving equipment can increase the efficiency of your program.

Much of the excavating is done by the giant HD-20G Tractor Shovel owned by Crawford Contractor's Ltd. This powerful hydraulic torque-converter driven unit combines crawler-tractor flexibility with the capacity of a four-yard shovel... is equally useful in stripping, loading and stockpiling.

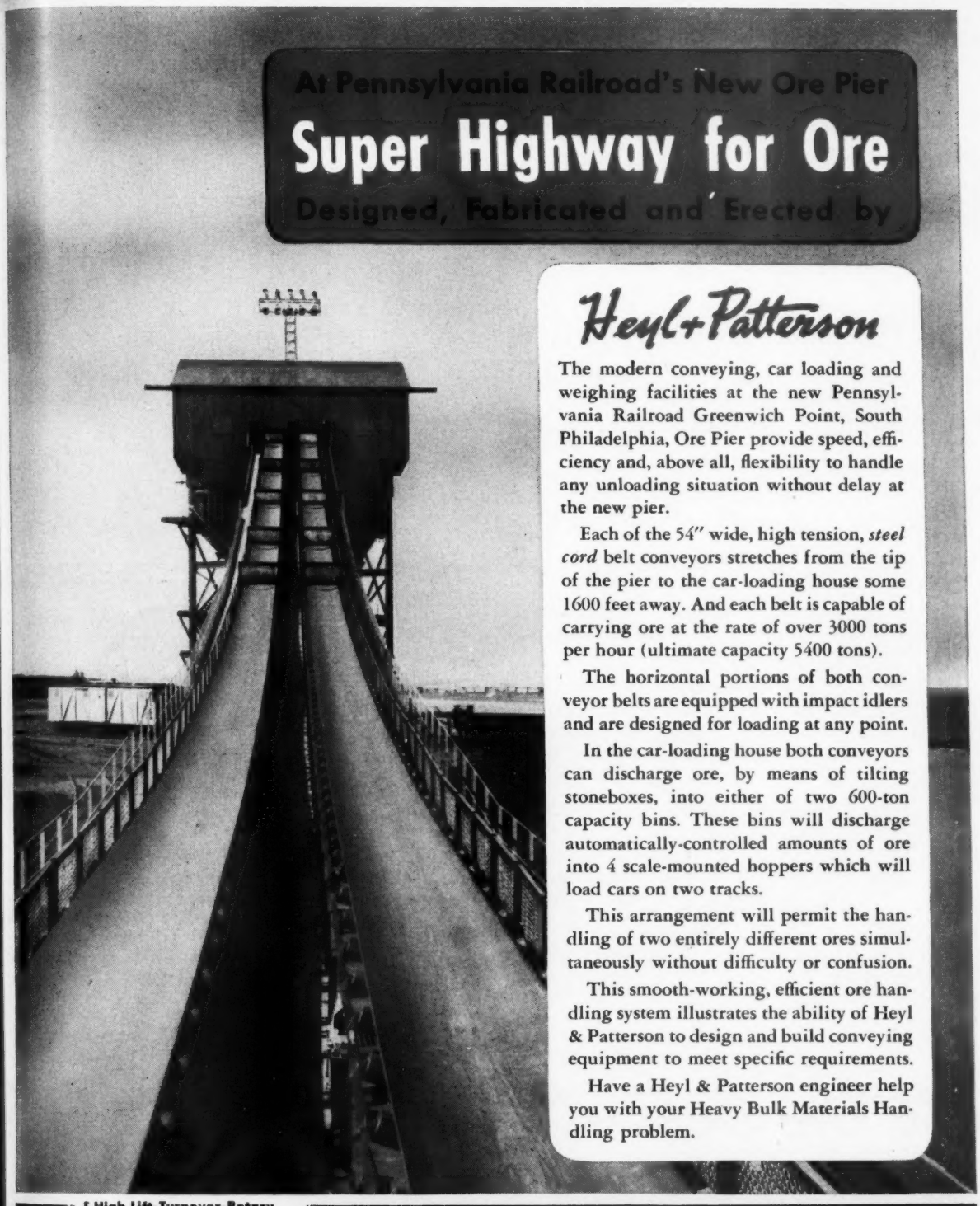
Three Allis-Chalmers HD-5G Tractor Shovels offer the responsive bucket control necessary to skim off the narrow coal seam cleanly. The high-grade coal resulting from this precision work has won many new customers for the Avon Company.

A second HD-20 with bulldozer handles large-scale stripping and stockpiles coal. It took powerful postwar equipment like this to make strip mining practical in the Minto Coal Field.

Keeping haul roads smooth is only a part-time job for the Allis-Chalmers Model D Motor Grader. Equipped with "midship" scarifier and hydraulic rear-end loader, the D has become a most versatile handy man around the mine.

ALLIS-CHALMERS

TRACTOR DIVISION • MILWAUKEE 1, U. S. A.



At Pennsylvania Railroad's New Ore Pier

Super Highway for Ore

Designed, Fabricated and Erected by

Heyl & Patterson

The modern conveying, car loading and weighing facilities at the new Pennsylvania Railroad Greenwich Point, South Philadelphia, Ore Pier provide speed, efficiency and, above all, flexibility to handle any unloading situation without delay at the new pier.

Each of the 54" wide, high tension, *steel cord* belt conveyors stretches from the tip of the pier to the car-loading house some 1600 feet away. And each belt is capable of carrying ore at the rate of over 3000 tons per hour (ultimate capacity 5400 tons).

The horizontal portions of both conveyor belts are equipped with impact idlers and are designed for loading at any point.

In the car-loading house both conveyors can discharge ore, by means of tilting stoneboxes, into either of two 600-ton capacity bins. These bins will discharge automatically-controlled amounts of ore into 4 scale-mounted hoppers which will load cars on two tracks.

This arrangement will permit the handling of two entirely different ores simultaneously without difficulty or confusion.

This smooth-working, efficient ore handling system illustrates the ability of Heyl & Patterson to design and build conveying equipment to meet specific requirements.

Have a Heyl & Patterson engineer help you with your Heavy Bulk Materials Handling problem.

- High Lift-Turnover-Rotary Railroad Car Dumpers
- Boat Loaders and Unloaders
- Ore Bridges
- Coal Handling Equipment
- Pig Iron Casting Machines
- Cyclone Thickeners
- Thorsten Coal Samplers
- Car Hauls and Boat Movers
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Heyl & Patterson, Inc.

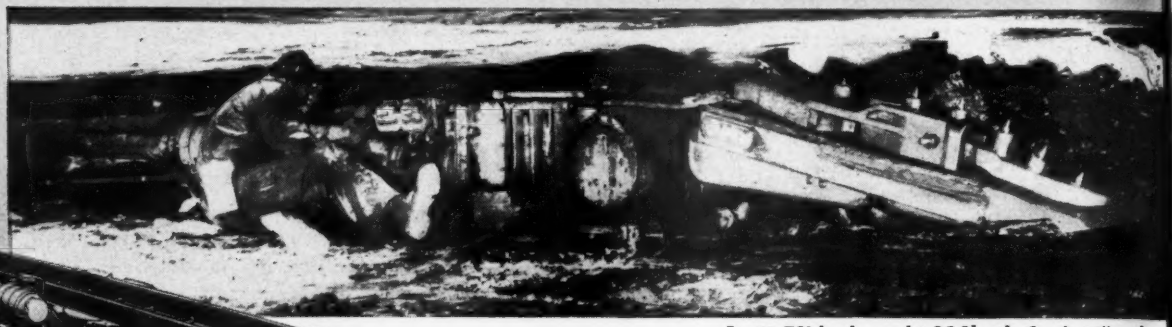
"SINCE 1887"

55 FORT PITT BLVD. PITTSBURGH 22, PA.

IF...YOU'RE MINING VERY LOW COAL...

Joy 20-BU in 28" coal

FOR REAL HIGH CAPACITY PRODUCTION...



Joy 20-BU loader and 8-SC Shuttle Car in 30" coal

...use the best—the 20-BU LOADER

The JOY 20-BU is only *24" high,* but its loading speed is up to 8 tons a minute!

An exclusive feature of the 20-BU is the independent drive of the conveyor and gathering head. While a shuttle car is away, the gathering arms continue to operate and can provide a fully loaded conveyor ready for quick loading when the car returns. This independent drive also permits continued loading by the conveyor even if the gathering arms are momentarily stalled with hard digging.

The 20-BU is a field-proved, tried and true machine that is boosting production and profits in low vein coal mining everywhere. Let us show what it will do for *you!* ● **Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

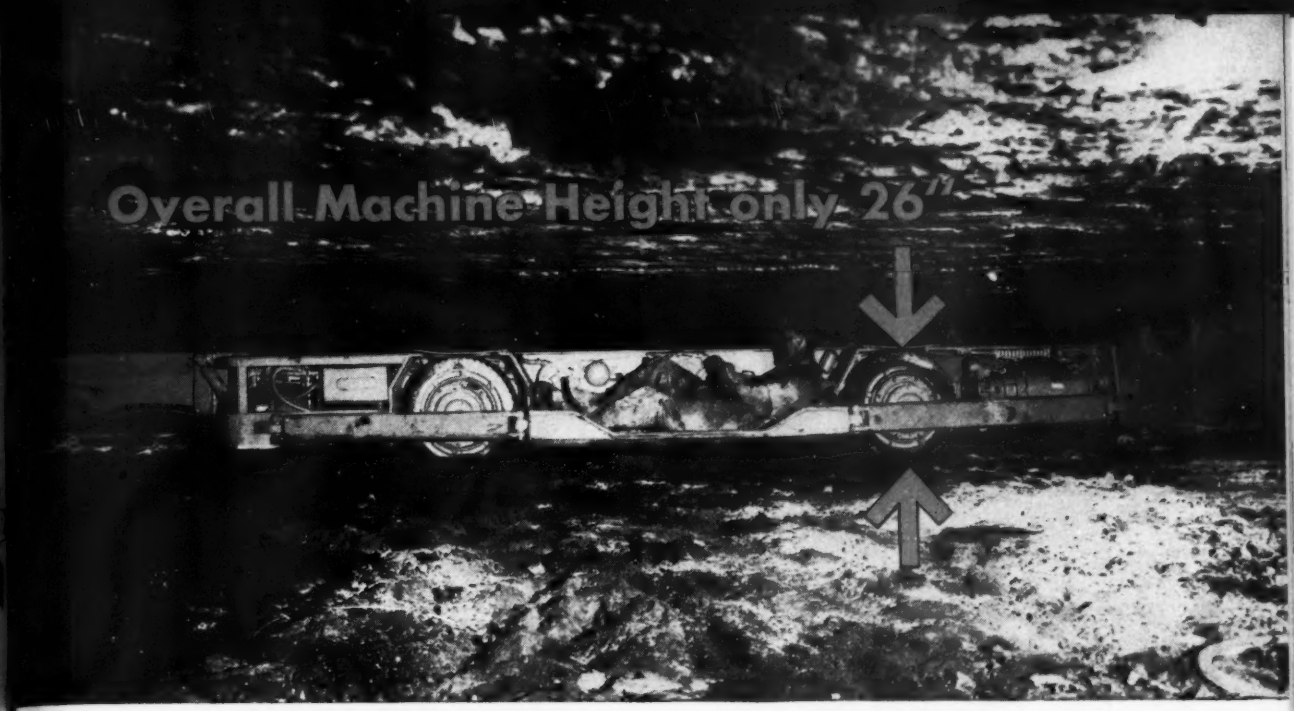
WRITE FOR BULLETINS, OR

Consult a Joy Engineer

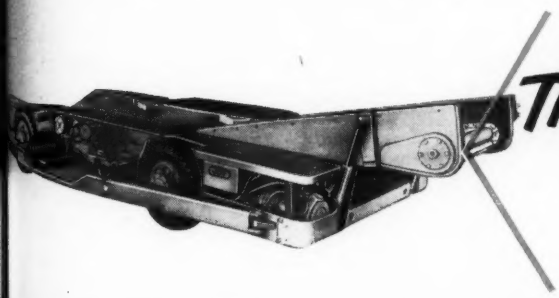
WBD CL 5066

JOY

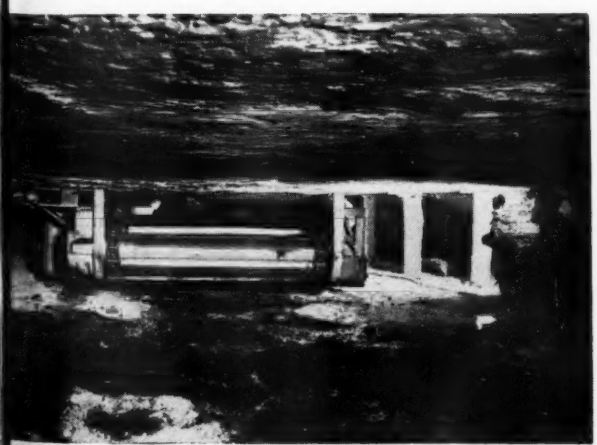
WORLD'S LARGEST MANUFACTURER OF UNDERGROUND MINING EQUIPMENT



When you're looking for dependable, high-tonnage hauling in very low coal...



The 8-SC SHUTTLE CAR is YOUR VERY BEST BET!



Only 26" high, the 8-SC Shuttle Car has a level capacity of 2 tons. With the 12-RB Cutter (26" high) and the 20-BU Loader (24" high), it constitutes the first high-capacity mechanized mining team for very low coal. Other Joy equipment for any mining need.

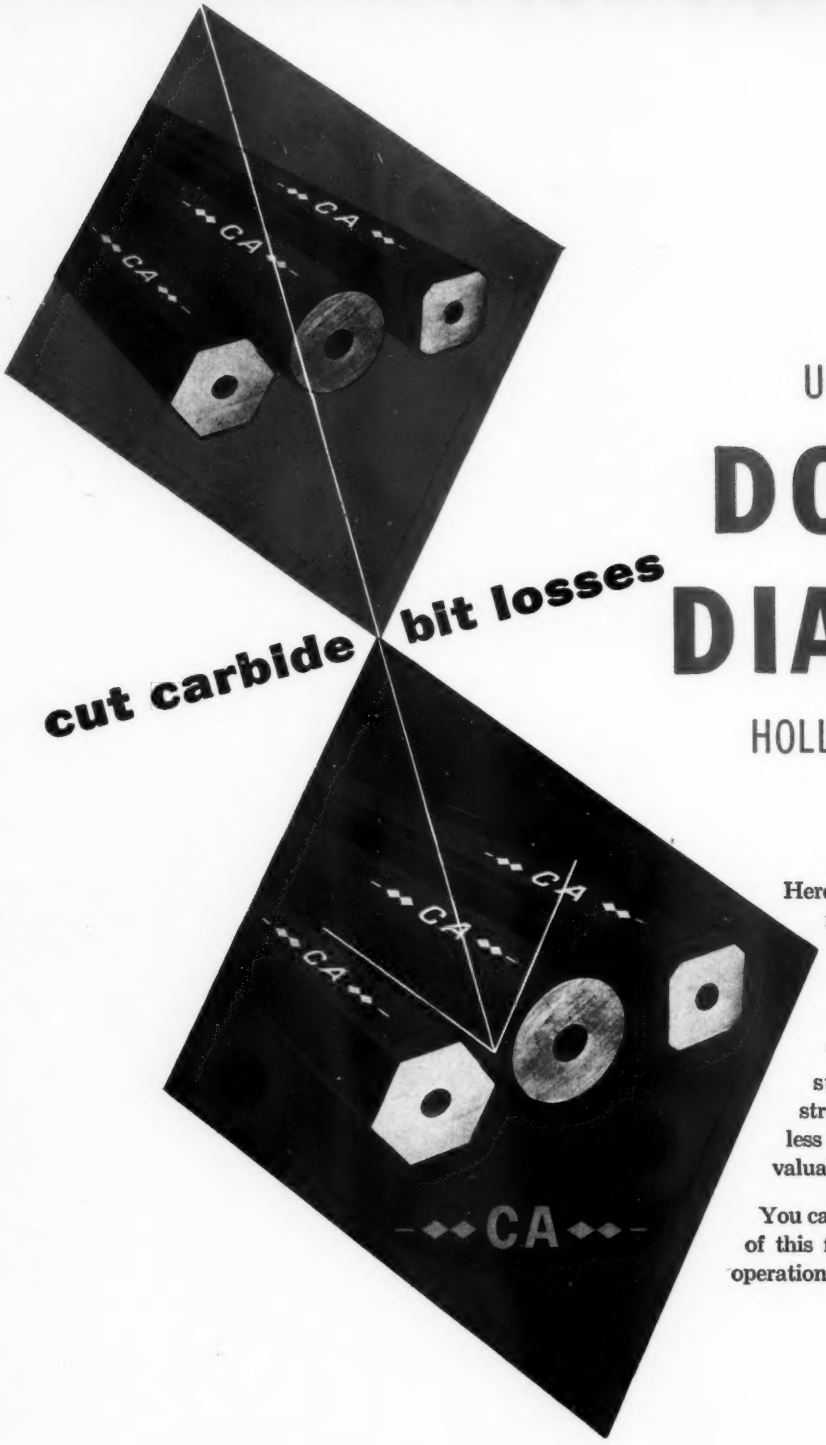
The 8-SC is highly maneuverable and flexible—it loads, unloads and gets back again fast and dependably . . . *and that's what keeps costs down and tonnage up!*

Features include: 4-wheel positive drive, 4-wheel brakes and 4-wheel steering, with a wider, tapered-end design that permits minimum turning clearance. Controls are centrally located; the operator has equal visibility in either direction. Separate motors for traction, conveyor drive and hydraulic pump drive. Hydraulic cable reel; hydraulically-adjustable elevating discharge. ● For full data, address ***Joy Manufacturing Company, Oliver Bldg., Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ont.*

Consult a Joy Engineer

JOY

WORLD'S LARGEST MANUFACTURER OF UNDERGROUND MINING EQUIPMENT



cut carbide bit losses

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Here's the finest, toughest hollow drill rod made. Crucible DOUBLE DIAMOND is made to tool steel specifications by the nation's leading producer of tool steels.

That's why it has greater fatigue strength . . . and greater fatigue strength means lower drilling costs—less down time and fewer losses of those valuable tungsten, carbide bits.

You can't afford to overlook the advantages of this fine alloy drill rod in your drilling operations. Write for full details.

CRUCIBLE first name in special purpose steels

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MAY, 1954

VOLUME 40 • NUMBER 5

Mining

CONGRESS JOURNAL

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Circulation
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Published Monthly. Yearly subscriptions, United States, Canada, Central and South America, $3.00. Foreign $5.00. Single copies, $0.30. February Annual Review Issue, $1.25. Entered as Second-class Matter, January 30, 1915, at the Post Office at Washington, D. C.

Indexed regularly by Engineering Index, Inc.

Opinions expressed by authors within these pages are their own, and do not necessarily represent those of the American Mining Congress

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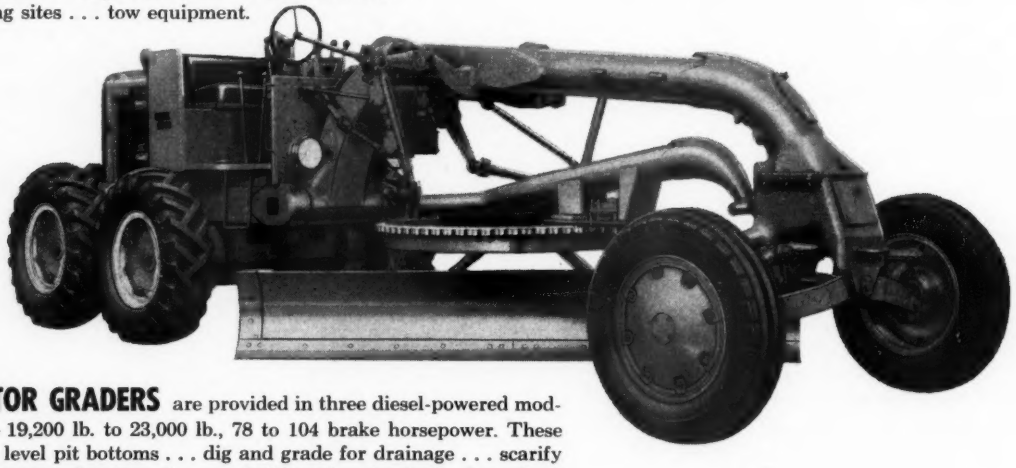
HOW 6 BASIC ALLIS-CHALMERS MACHINES

mechanize and speed mining production

In today's competitive era, mining requires modern, versatile equipment that enables mine operators to increase output per man-hour and keep maintenance time to a minimum. To answer this need, Allis-Chalmers provides a line of newly designed heavy-duty equipment — 6 basic machines that mechanize and speed material moving and handling in many phases of mining production.

1 **CRAWLER TRACTORS.** Allis-Chalmers builds four sizes of heavy-duty diesel tractors: HD-5—10,500 lb., 40 drawbar hp.; HD-9—18,800 lb., 72 drawbar hp.; HD-15—27,850 lb., 109 drawbar hp. (hydraulic torque converter drive optional); HD-20 — 41,000 lb., 175 net engine hp. — hydraulic torque converter drive. With cable or hydraulic bulldozer blades they build access roads . . . maintain tailings dumps . . . clean up around shovels . . . cut drainage ditches . . . dig sludge basins and sluiceways . . . build reservoirs and pond dams . . . strip overburden . . . clear and level building sites . . . tow equipment.



2 **MOTOR GRADERS** are provided in three diesel-powered models — 19,200 lb. to 23,000 lb., 78 to 104 brake horsepower. These units level pit bottoms . . . dig and grade for drainage . . . scarify . . . prepare dragline sites . . . build and maintain haul roads. A gasoline-powered Model D Grader is also available. It handles routine road maintenance and light construction.

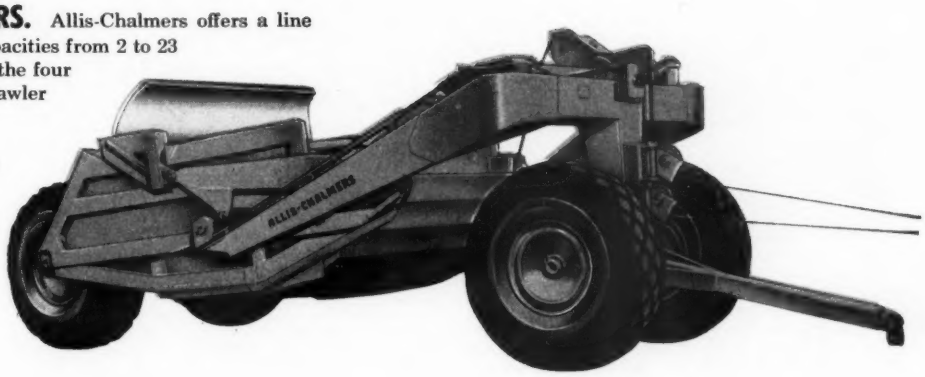
3 **TRACTOR SHOVELS** are available for all four sizes of Allis-Chalmers tractors. Standard bucket sizes range from one to four cubic yards —light materials up to seven cubic yards. These machines handle ore, tailings, coal and other bulk materials . . . clean up around shovels and hoppers and conveyors. Underground they load hauling units and excavate to reach new ore. Units are hydraulically controlled.

4

MOTOR SCRAPERS. The 18-yard (heaped) diesel-powered TS-300 Motor Scraper strips overburden, loads, hauls material from open pit . . . clears and levels for campsites and drill setups . . . levels and grades for access roads, building sites . . . hauls in supplies. A smaller 13-yard (heaped) TS-200 Motor Scraper is also available.

5

PULL-TYPE SCRAPERS. Allis-Chalmers offers a line of seven scrapers with capacities from 2 to 23 cubic yards. Matched to the four sizes of Allis-Chalmers crawler tractors, these tractor-scraper teams load and haul ore-bearing material . . . handle large-scale stripping jobs.



6

ROCK WAGON. The TR-200 Motor Wagon hauls tailings, sand, gravel, overburden and ore. Unit travels fast "off-road" with capacity loads . . . dumps clean every time with 18-ton hydraulically controlled rear-dump body. Double layer steel bottom with oak plank filler absorbs rock shock of overhead loading. A 22-ton bottom-dump Motor Wagon also available.

Write for catalogs or get the complete facts from your nearby Allis-Chalmers dealer.

ALLIS-CHALMERS

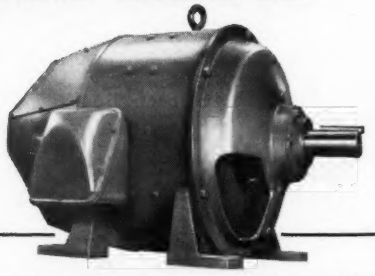
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

AT WHITE PINE COPPER MINE—

RELIANCE MOTORS PROVE DEPENDABILITY HAULING ORE UP TOUGH GRADES

The rugged Reliance D-c. Motors that power the 12-ton shuttle cars at White Pine Copper Mine, White Pine, Michigan, prove over and over again that Reliance builds "The Toughest Motors Ever Built". Twenty-four hours a day, these motors take their heavy loads over wet, mucky haulage ways, up a long 10% grade to the portal. And outdoors, in all kinds of weather, up another grade, this time 13%, to the storage pile. On the return trip, these same motors provide dynamic braking for sure control on the downgrade.

This is one more example of the way Reliance provides the right combination of dependable equipment . . . plus skillful application of that equipment . . . to get maximum results. For prompt, capable assistance with any electric motor problem, call your nearby Reliance Sales Office . . . or write us direct. C-1472



"THE TOUGHEST MOTORS EVER BUILT"

Reliance Protected Open Type 'T' Heavy-Duty Motor. All other standard enclosures available, with wide choice of mechanical designs and special mountings. Ratings from 3/4 to 1000 hp., for constant or adjustable speeds, with shunt, series, or compound windings. For details, request Bulletin C-2001.

RELIANCE ELECTRIC AND ENGINEERING CO.

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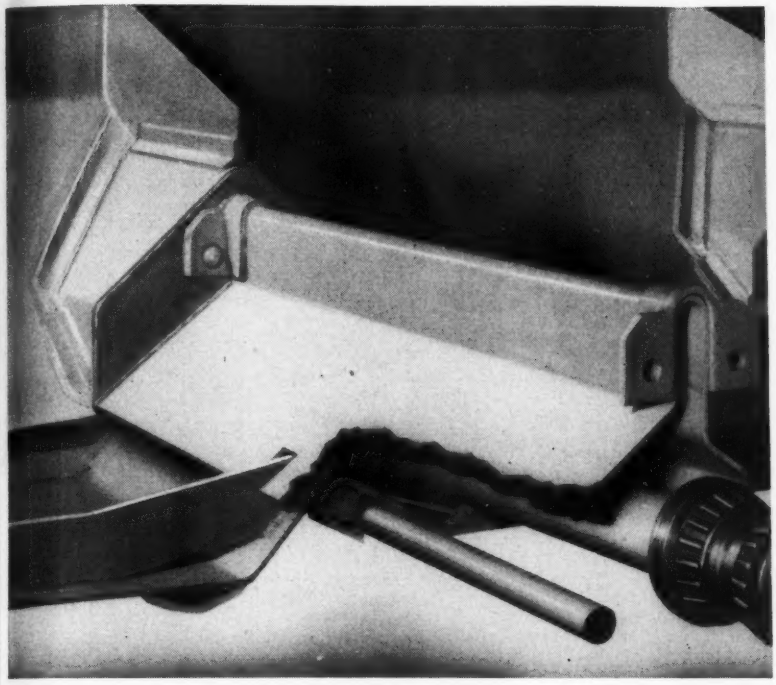
Only S-D "Automatics" are Safety Sealed Against Dust Leakage



THE DUST STAYS IN THE CAR

The detail drawings above show how you can keep dust off your tracks with the S-D "Sealed Automatic." In the circle at top is shown the conventional drop bottom construction and how dust shakes down and out through the necessary clearance space between the door and the car frame. The lower circle shows how our new Safety Dust Seal carries sifting dust across the open space, providing a 100% effective dust seal.

BEFORE buying mine cars it is important to know that S-D Automatic Drop Bottom Mine Cars offer you an exclusive seal against dust leakage. This means two extra values: (1) Sealed S-D "Automatics" give you a new, safer in-the-mine operation by eliminating leakage of dust. (2) Sealed S-D "Automatics" enable you to make a tremendous reduction in track clean-up costs.

Photograph above of a cross section view of the inside of a Sealed S-D Automatic shows you why dust cannot shake down and out through the necessary clearance space between doors and frame. Note how hood overlaps the drop bottom doors at the ends. Note also the Safety Dust Seal over door clearance space. (This side seal is best illustrated in the detail drawing showing S-D's new Sealed Automatic design.)

Other advantages offered by S-D Automatic Bottom Dumping cars include: (1) from ¼ to ½ ton greater capacity for any overall dimensions and (2) the S-D "Twin Safety Latches" . . . two latches for safe and sure latching that are tripped independently underneath the car for automatic dumping. For complete information write us today.

Sanford-Day Iron Works
KNOXVILLE TENNESSEE

the bits of The Bowdil Company are sold and known in the trade by the following registered trademarks

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U. S. PATENT OFFICE

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BOYLAN AVENUE S. E. • CANTON 7, OHIO

"Say, what's wrong with my mine cable?"

"Lots of times we find cable sections like this—necked-down. And that's only one of our troubles. Our cables short out too often. Sometimes jackets creep back from splices. Other times we find broken ground wires. What in thunder are we doing wrong?"

"Well, here's a big part of your trouble:"

"Hourglass sections are a sure sign of too much tension on the cable. So are the other troubles you mention. To end tension . . . keep spring-type shocks at the power source. Keep the reel pulling evenly. Adjust it so there's no back-spooling. Watch out for kinks. And be sure you use a cable that can take it when the going gets tough. Then you'll put an end to your trouble and keep your cables on the job far longer. And remember, one break costs more than the difference in price between a cheap cable and a quality one!"

Be sure with Anaconda's new shuttle car cable

Are cables all alike? No! Quality cables — like ANACONDA's Securityflex* — have proved themselves over the years. Here's why ANACONDA Cables last longer and are safer. The ground wire can stretch more. It will *not* break before the power conductors. *That's a real safety feature.* Jacket is made of a new Neoprene formula. It is stronger. Insulation is long-life, tough cold rubber. It all adds up to real economy *in use.* Get the full facts from your Anaconda Representative. *Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.*

*Trade Mark

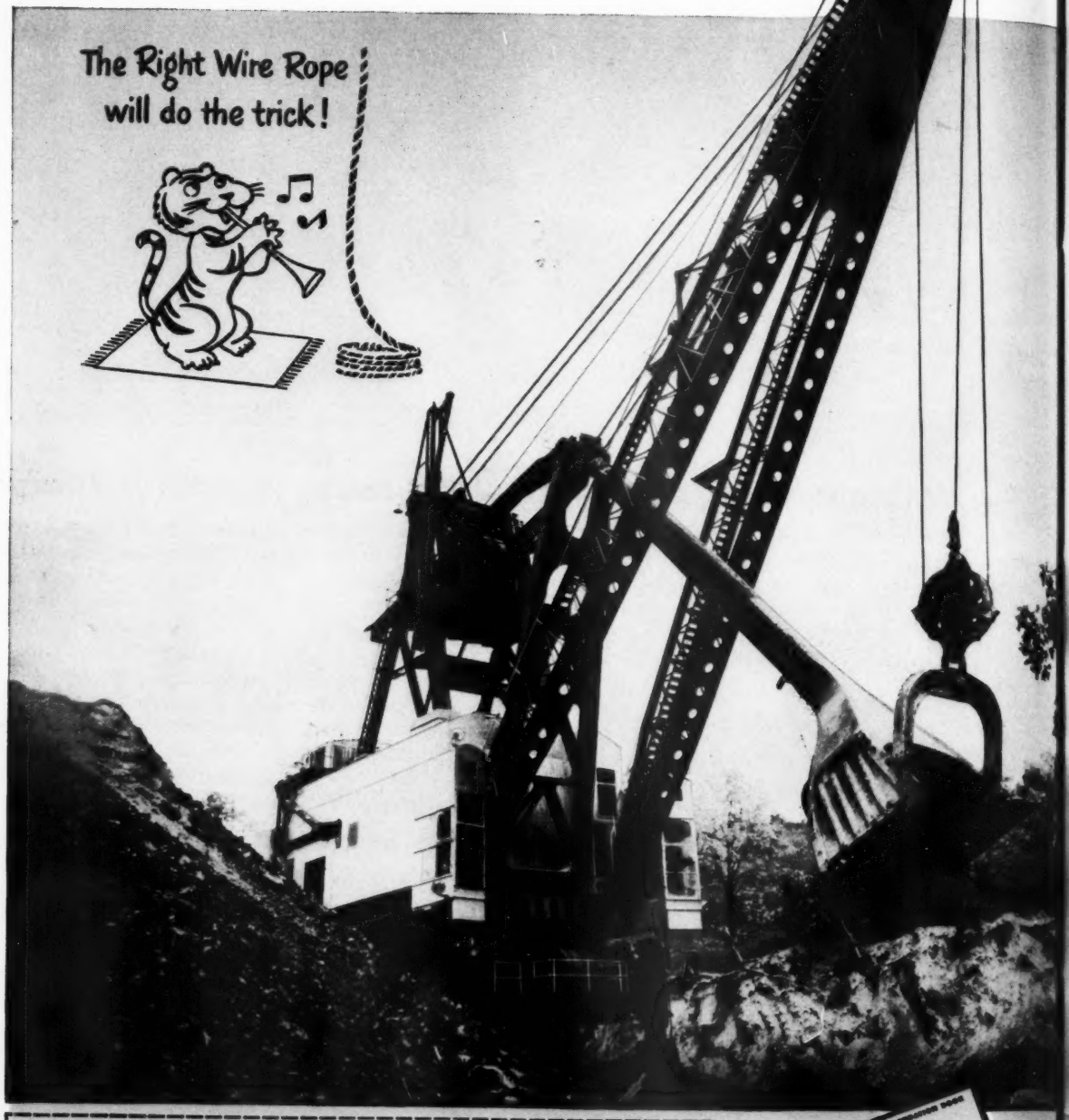
54337

the right cable for the job

ANACONDA®

WIRE AND CABLE

12,587 carloads of ov



American Steel & Wire
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Cleveland 13, Ohio

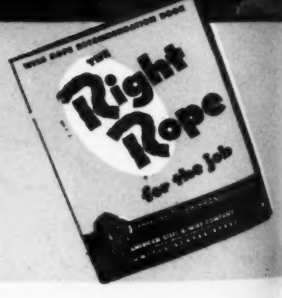
FREE ROPE BOOKLET →

Please send me, without obligation, a copy of your booklet, "The Right Rope for the Job," which lists the correct Tiger Brand Ropes to use for hundreds of typical applications.

Name.....

Address.....

City & State.....



# of overburden moved with one Tiger Brand Hoist Rope

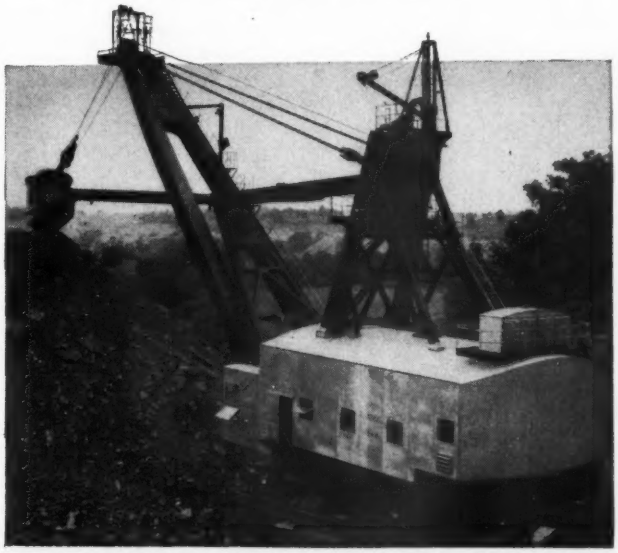
IMAGINE 12,587 50-ton freight cars strung out end-to-end. They would make a train more than 80 miles long; and if each car was level full, the entire train would contain 1,000,000 cubic yards of material. That's how much overburden this big coal stripping shovel moved with one American Tiger Brand Hoist Rope.

Despite hard digging, a 2⅜" Tiger Brand Wire Rope lifted and lowered the fully loaded 45 cu. yd. bucket *20,000* times before it had to be replaced. This equipment is used by Central Ohio Coal Company which supplies coal for The Ohio Power Company's new Muskingum River electric power generating plant. This company also uses Tiger Brand Wire Rope on its 18 cu. yd. shovels.

You will like Tiger Brand, too. It lasts long in *any* type of service.

Send the coupon for our recommendations of the right rope to use on your machines.

Regular lubrication of sheaves helps prevent excessive wear of the Tiger Brand Ropes on these big machines.



This 18 cu. yd. electric shovel and the 45 cu. yd. job shown on the opposite page are stripping overburden 3 shifts a day *every* day at Central Ohio Coal Co.'s big Muskingum Mine near Zanesville, Ohio. Tiger Brand Rope is giving excellent service on both these hard-working machines.

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL CORPORATION
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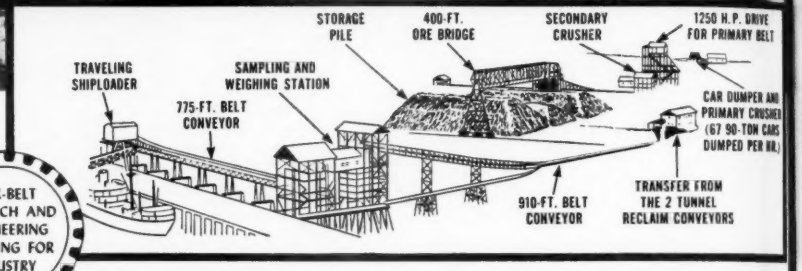
U·S·S AMERICAN TIGER BRAND WIRE ROPE

Excellay Preformed

USS

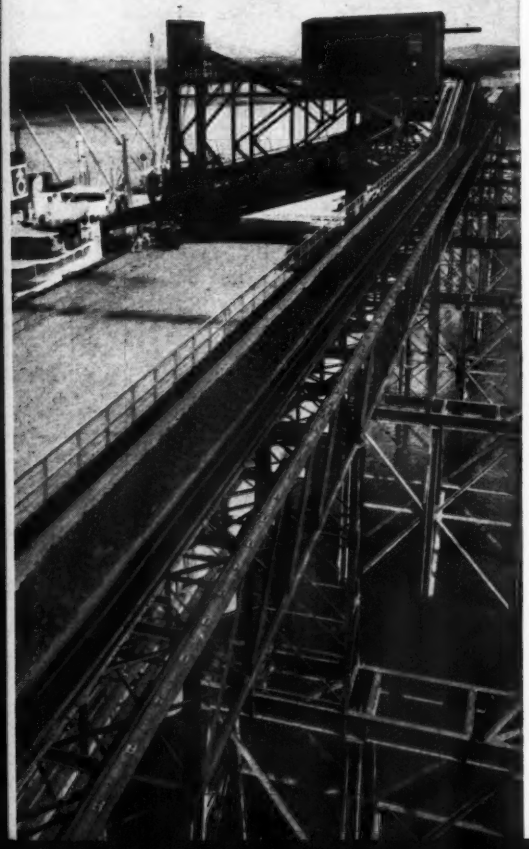
UNITED STATES STEEL

Moving Venezuelan iron ore to the sea


STORAGE PILE
400-FT. ORE BRIDGE
SECONDARY CRUSHER
1250 H.P. DRIVE FOR PRIMARY BELT
TRAVELING SHIPLOADER
SAMPLING AND WEIGHING STATION
775-FT. BELT CONVEYOR
CAR DUMPER AND PRIMARY CRUSHER (67 90-TON CARS DUMPED PER HR.)
910-FT. BELT CONVEYOR
TRANSFER FROM THE 2 TUNNEL RECLAIM CONVEYORS

• Aerial photograph and schematic flow sheet trace ore's movement from railhead to ship. Below: Link-Belt belt conveyors along dock and boom load a ship. The facility may be expanded, when necessary, to load ships at 12,000 long tons per hour.

LINK-BELT RESEARCH AND ENGINEERING WORKING FOR INDUSTRY



Link-Belt fulfills a single-contract responsibility for design, fabrication and erection of giant ore handling system at Puerto Ordaz

TO MOVE Cerro Bolivar's ore from mine car terminal to ocean-going ships, U. S. Steel's Orinoco Mining Co. appointed Link-Belt the prime contractor. The project was engineered, fabricated and installed in 23 months—approximately five months ahead of schedule. This was accomplished with the excellent cooperation of suppliers and of our subcontractors, Wellman Engineering Co., and McDowell S. A. of Caracas.

As the ore moves via Link-Belt belt conveyors to the ships, it is crushed in two stages. En route it is also stock-piled, to be reclaimed as needed at a rate of up to 6000 long tons per hour. The shiploader is versatile enough to handle all types of ocean-going ships plus a 39-ft. annual water level variation of the Orinoco river. One shiploader operator electrically controls the speed and capacity of the entire reclaiming system—from storage pile to the ship.

Although the Puerto Ordaz project is extremely large, it typifies the service offered by Link-Belt. Under a single contract, Link-Belt offers unified responsibility for complete materials handling and processing plants — from design to successful operation. A call to your nearby Link-Belt sales office will place the facilities of this comprehensive organization at your service.

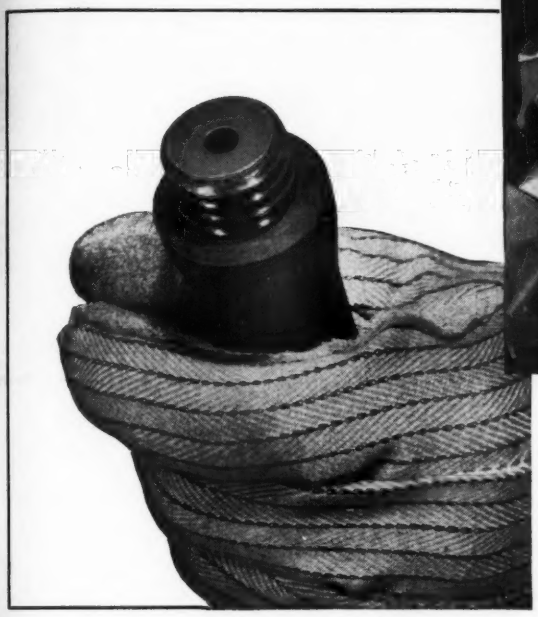
LINK-BELT

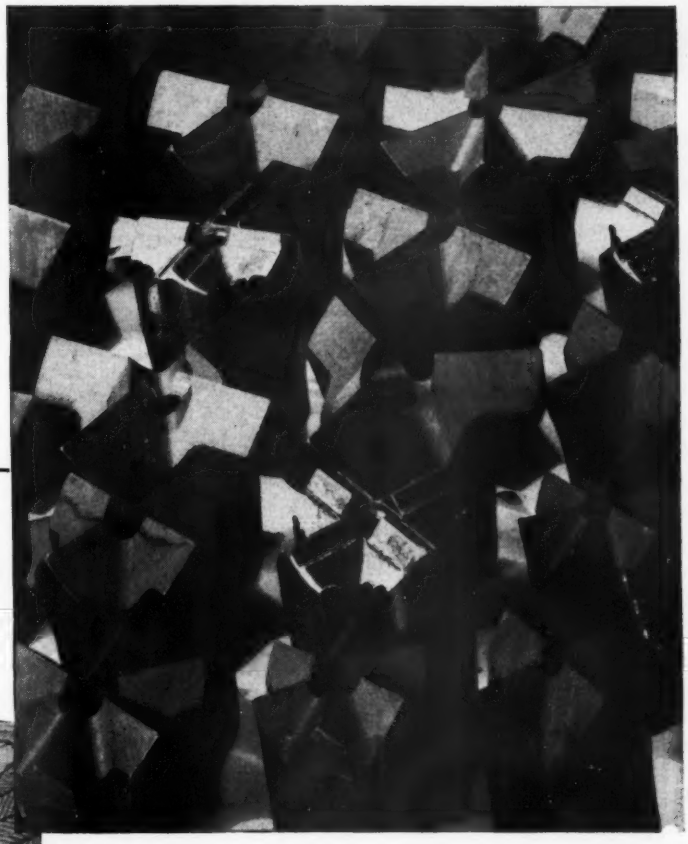
One source . . . one responsibility for materials handling and power transmission machinery

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

13.401

Dozens of different TIMKEN® bits fit this drill steel!





Switch bit types and sizes without changing steels—drill faster and more efficiently

HERE is one of the greatest boons to rock drilling ever developed—the interchangeable Timken® carbide insert and multi-use rock bits. All the bits in each series fit the same steel and in one series there are *dozens* of different Timken bits.

Think how this can increase your drilling speed and efficiency. When a different bit is needed, the driller simply screws one on—without all the time and expense of going after new drill steels. Or if the ground changes, you can quickly switch to the best bit right on the job. For example from Timken multi-use bits to carbide insert bits. They're interchangeable on the same steel.

All Timken bits are made from our electric furnace Timken alloy steel. And the threads in all Timken bits are protected against drilling impacts by the special shoulder union developed by the Timken Company.

For over 20 years, the Timken rock bit engineering service has helped solve drilling problems. There's no obligation for this valuable service. Write: The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".

WHERE YOU CUT COSTS WITH TIMKEN MULTI-USE BITS

Most economical for ordinary ground. With correct and controlled reconditioning, they give lowest cost per foot of hole when full increments of steel can be drilled.

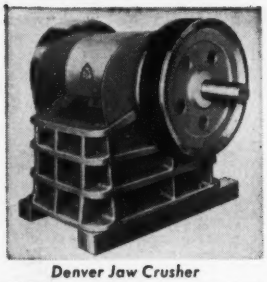
WHERE YOU CUT COSTS WITH TIMKEN CARBIDE INSERT BITS

Give highest speed through hard, abrasive ground. Also most economical for constant-gage holes, small diameter holes, very deep holes.

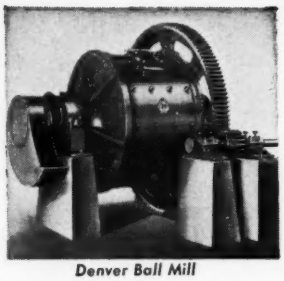
. . . your best bet for the best bit . . . for every job

TIMKEN

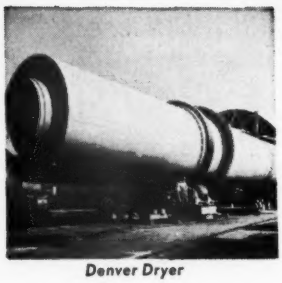
TRADE-MARK REG. U. S. PAT. OFF.



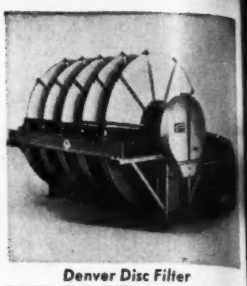
Denver Jaw Crusher



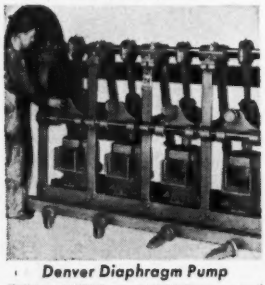
Denver Ball Mill



Denver Dryer

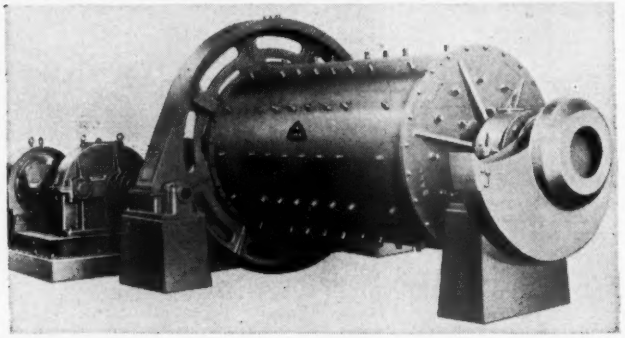


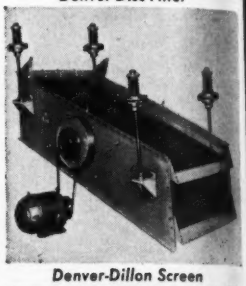
Denver Disc Filter



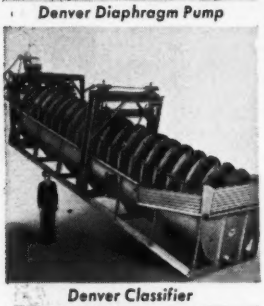
Denver Diaphragm Pump

5' x 10' Denver Steel-Head Rod Mill... one of 21 Denver Ball and Rod Mills furnished one customer

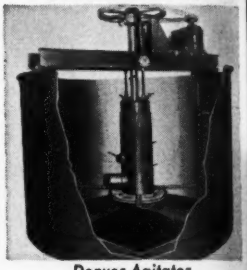




Denver-Dillon Screen



Denver Classifier

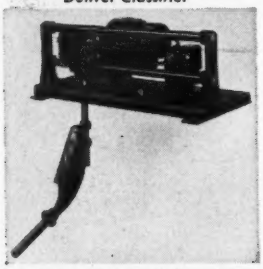


Denver Agitator

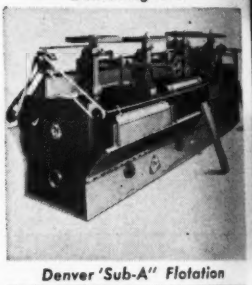
DENVER STEEL-HEAD BALL-ROD MILLS

4-times greater strength than cast iron!

Denver Ball and Rod Mills are made with cast-steel heads integral with trunnions, giving 4-times greater tensile strength than cast iron. Steel-head design permits a choice in type of construction... heads may be welded to the rolled steel shell or bolted to a steel flange welded to shell. Sizes: 30" x 18" to 6' x 24'.



Denver Automatic Sampler



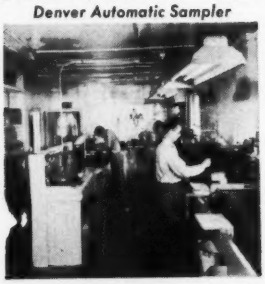
Denver 'Sub-A" Flotation

DIAMETER MEASURED INSIDE LINERS

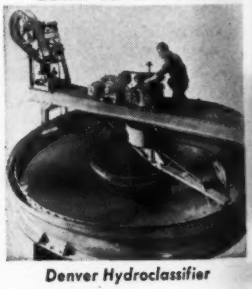
Diameter of the Denver Steel-Head Ball-Rod Mills is measured inside liners... giving up to 28% greater capacity than mills with liners measured inside shell.

FLEXIBILITY WITH STANDARDIZED DESIGN

With the standard Denver mills you have a choice of several types of feeders, discharges, trunnions, and drives... a combination may be selected to fit your particular problem, without the high cost of specially built mills. You can depend upon obtaining "Standard-Reliable-Efficient" performance with Denver Steel-Head Ball-Rod Mills... write, now, to any of the conveniently located Deco offices, for Bulletin B2-B13.



Denver Testing Service



Denver Hydroclassifier

"The firm that makes its friends happier, healthier and wealthier"

DECO FLOTATION ENGINEERS — DENVER EQUIPMENT 24 HOUR SERVICE COMPANY

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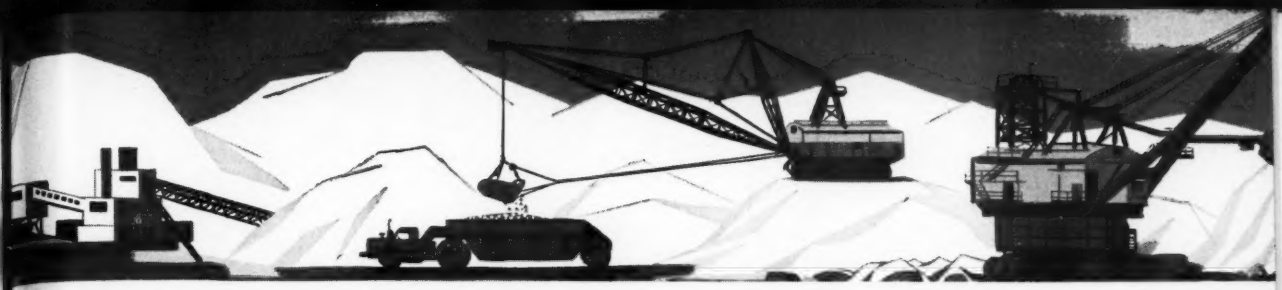
Offices also in El Paso, Vancouver, Mexico, D.F., London, Johannesburg



Now! cut application costs and grease inventories with

NEW STANOLITH GREASE MP

You need only this *one* grease for many kinds of heavy equipment!

Added high-load carrying capacity!

Resists both water and high temperatures!

Here is a newly formulated grease with such an increase in multi-purpose range that it helps you *cut application costs* and *reduce grease inventories*. Higher oil viscosity and greater extreme pressure properties make it suited for wide use in steel mills, cement mills, rubber mills, mining operations—all other heavy equipment industries.

More than just an "E. P." grease, New STANOLITH MP has all of the outstanding properties of STANOLITH greases: excellent oxidation stability and good mechanical stability. It has extreme water resistance and withstands high temperatures—*it will not thin out*. For better protection of all kinds of heavy equipment, under a wide range of conditions, use STANOLITH Grease MP.

New STANOLITH Grease MP takes its place with famous STANOLITH Greases No. 42 and No. 57 to give you the most versatile collection of multi-purpose greases in modern industry.

STANDARD OIL COMPANY *(Indiana)*

Call your nearby Standard Oil lubrication specialist and let him show you how Standard's "multi-purpose" greases can save you money and help you avoid trouble.

STANDARD

C·M·I

CENTRIFUGAL COAL DRYERS...

FOR DRYING COAL

the Economical Way!

A C-M-I Centrifugal Coal Dryer may be the efficient, profitable and economical answer to all your coal drying problems . . .

The continuous centrifugal drying method, as perfected by C-M-I, is far less expensive than heat drying when used for preliminary dewatering and may, in many cases, eliminate entirely the need for costly heat drying. With typical American ingenuity, C-M-I has developed the original Elmore patents of over forty years ago to a peak of previously undreamed of efficiency. In fact, modern C-M-I Dryers not only save money . . . *they actually earn money!* Every year C-M-I Dryers reclaim thousands of tons of marketable coal from slurry ponds . . . paying for themselves in this one operation alone in a remarkably short time!

C-M-I, manufacturers of the world's finest centrifugal dryers, maintains a complete laboratory with facilities to solve individual dewatering problems. This service is available to all in the coal industry, entirely without obligation, of course. Send a description of your problem and your requirements to C-M-I; we'll be most happy to recommend an economical and practical solution.

C·M·I Centrifugal DRYERS

CENTRIFUGAL & MECHANICAL INDUSTRIES

146 PRESIDENT STREET . . . . . SAINT LOUIS 18, MISSOURI

IT'S HERE! The new LINK-BELT SPEEDER LS-98

FULL 1-YARD SHOVEL-CRANE

with Speed-o-Matic® power hydraulic control!

Now, for the first time in the heavy duty 1-yd class, you can buy a machine combining unsurpassed productive capacity and maneuverability with practical transportability. In fact, an LS-98 with Speed-o-Matic control gives you the greatest productive capacity of any shovel-crane conveniently transportable over most state highways.

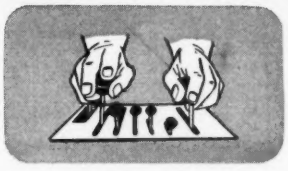
Two years of rugged field testing proved the LS-98 outstanding from both productive and service cost standpoints. It's an ideal machine for widely scattered operations as well as for big production jobs. Fully convertible, the LS-98 is your answer to handling more work at less cost.

Ask your distributor or write for the 98 Series catalog and the booklet on Speed-o-Matic control.

LINK-BELT SPEEDER CORPORATION
Cedar Rapids, Iowa 13.495-A

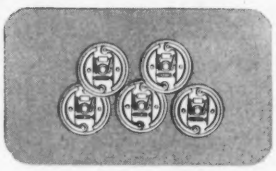
It's the industry's MOST ADVANCED shovel-crane

Included as standard equipment are foolproof power steering and independent rapid boom hoist. These and many other advantages enable you to secure greater output at lower cost.



Fingertip, Speed-o-Matic control is easy on the operator . . . cuts end-of-the-shift letdown . . . helps increase output up to 25%! Smooth, instant response eliminates jerk, jump or lag.

Greater usable hp, more live weight The LS-98 advanced design insures more efficient application of engine hp...incorporates greater live weight and strength to utilize extra hp.



Interchangeable, shoe type clutches The exclusive, self-adjusting Speed-o-Matic clutches are internal-expanding, easily accessible, all are interchangeable. Shells are alloy cast iron.

BUILDERS OF A COMPLETE LINE OF CRAWLER, TRUCK AND WHEEL-MOUNTED SHOVEL-CRANES

LINK-BELT SPEEDER

JEFFREY 81-A crawler loader

high in production . . . low on maintenance

Powered by Jeffrey 15 HP head and traction motors, the 81-A Crawler Loader sets a new pace in coal mining — a fast, easily maneuvered, highly productive machine, with design emphasis on simplicity and unit construction.

Now . . . for medium-low coal . . . the 81-A is available in two heights. You'll like the way it hits its stride quick and holds steady with peak performance. Rated capacity is 8 TPM; maximum capacity is 10 TPM.

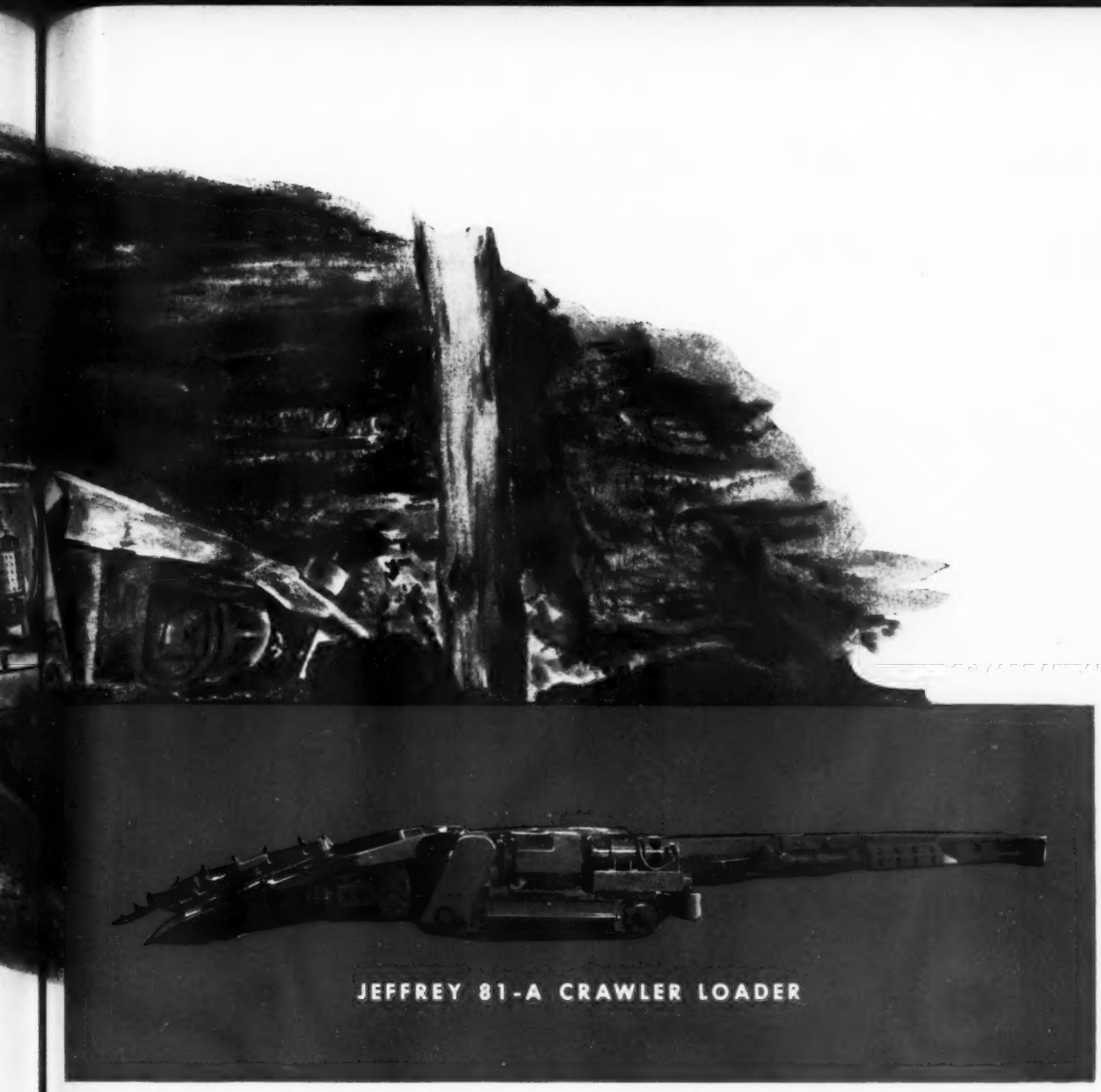
Check a few of the engineering details — features which combine high production and low maintenance to make the 81-A today's best loader buy:

GENERAL — The 81-A is extremely well balanced. Machine is 6'2" wide, 23'8" long and weighs 19,500 lbs.

MOTORS — Four rugged Jeffrey 15 HP motors plus a 4 HP hydraulic pump motor give the 81-A a total punch of 64 horsepower — ample power for the toughest jobs.

HEAD — Gathering head is fully gear driven . . . no chain drives between head motors and gathering arms.

TRACTION — The 81-A trams at 137 FPM for quick moving from place to place. Jeffrey chain used for traction drive.



JEFFREY 81-A CRAWLER LOADER

CONVEYOR—Jeffrey articulated chain hits a speedy 356 FPM. Conveyor will swing 45 degrees either side of center . . . will elevate to properly load shuttle cars on the straight or in breakthroughs.

MAINTENANCE—Here's another bonus with the 81-A. Head and traction gear parts are interchangeable between left and right hand sides. Every motor and gear case is a separate, detachable unit. Simplicity and unit construction throughout mean fast replacement, low maintenance costs.

THE JEFFREY 81-B—The Jeffrey 81-B Crawler Loader has the same design specifications as the 81-A, except Jeffrey 10 HP head and traction motors are furnished instead of 15 HP. The 81-B has a rated capacity of 6 TPM and a maximum capacity of 8 TPM. Tram speed is 114 FPM. For lower initial cost, ask about the 81-B. Two heights available.

THE JEFFREY MANUFACTURING CO.

ESTABLISHED 1877

Columbus 16, Ohio

sales offices and distributors in principal cities

PLANTS IN CANADA, ENGLAND, SOUTH AFRICA

IF IT'S MINED, PROCESSED OR MOVED . . . IT'S A JOB FOR JEFFREY!

FOR THAT EXTRA MARGIN IN SHOVEL PERFORMANCE...

WARD LEONARD ELECTRIC EXCAVATORS

MORE OUTPUT even under the toughest conditions . . . more loads per shift in any quarry or mine . . . extra loads for that EXTRA MARGIN in performance . . . that's what you get from this exclusive combination of shovel front-end features:

1. **TWO-SECTION BOOM** provides maximum strength with minimum weight. The lower section is rigidly connected to the A-frame . . . takes the heavy stresses of the digging cycle in stride because it is part of the main machine.

2. **TUBULAR DIPPER HANDLE** is much lighter than equivalent two-member handle, yet equally strong. Its ability to rotate in the rubber-cushioned saddle block eliminates torsion during the digging stroke, minimizes shock loads.

3. **TWIN DUAL HOIST ROPES** assure a steady, positive digging action with automatic shift of hoist power to that part of the dipper lip where it is needed.

4. **INDEPENDENT ROPE CROWD** is simple, positive and quiet. Shipper shaft pinions and handle racking are eliminated. Crowd machinery is located on main deck rather than on boom — swing inertia is reduced, the operating cycle speeded up.

5. **QUICK CONVERTIBILITY** to dragline of the independent motor type. Hoist and drag functions are powered by separate motors, eliminating operating clutches and brakes. 5154

These features — plus many more — make Bucyrus-Eries the finest heavy-duty excavators ever built: yard for yard, dollar for dollar, pound for pound. Write today for complete information on the 4½-yd. 110-B, the 6-yd. 150-B, or the 8-yd. 190-B.

Bucyrus-Erie Company

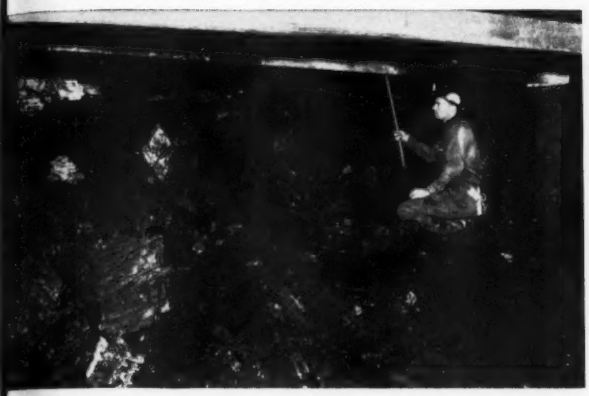
SOUTH MILWAUKEE WISCONSIN

[*Page 22*]

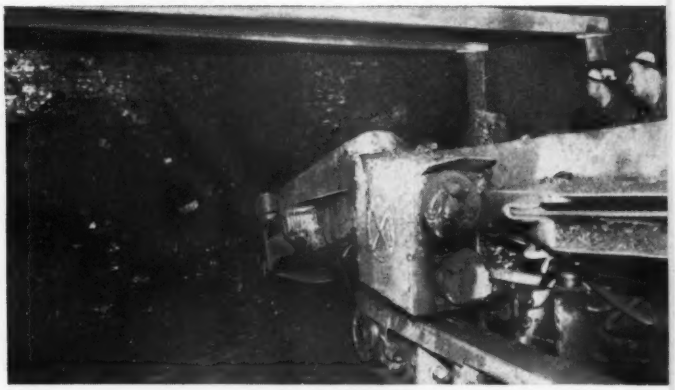
"We get maximum production of coarse coal nder all conditions with Du Pont 'Monobel' AA,"

states George Higinbotham, president,
Consolidation Coal Company (W. Va.), Fairmont, W. Va.

"We've used 'Monobel' AA ever since it was first introduced into the northern West Virginia district," continued Mr. Higinbotham. "It consistently gives us top-quality coarse coal and, personally, I think it's the most dependable permissible that's come along. Our No. 32 mine at Owings, W. Va., is a typical operation using 'Monobel' AA."

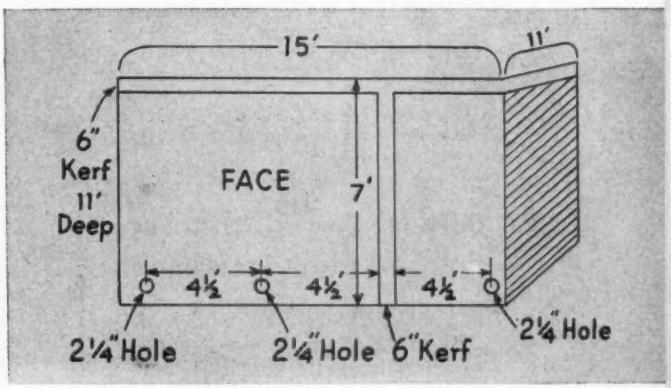


1. Characteristic fall of coal made with Du Pont "Monobel" AA in Consolidation's No. 32 mine. L. H. Kelly, foreman, sounds roof after shot. In his opinion, "'Monobel' AA lays the coal down loose, gives good loadability with minimum of fines."



2. Loader moves in quickly after shot, since "Monobel" AA makes a minimum of fumes and smoke. Its water resistance withstands wet bottom hole conditions. Wide spreading action of "Monobel" AA shears back of the cut and ribs cleanly.

3. Loaded buggy shows high percentage of coarse coal consistently produced by "Monobel" AA . . . representing profitable, high tonnage per man. Small percentage of fines makes cleaning easier and faster.



4. This standard shooting pattern used in No. 32 mine was developed in cooperation with Du Pont technical service men. All rooms are top cut and sheared. Du Pont Iron Wire Electric Blasting Caps are used for maximum economy.

Widely used throughout the coal-mining industry, Du Pont "Monobel" AA has earned the approval of many prominent mine owners and operators. Their experience has proved it to be the most satisfactory permissible they've found. Try it in your own operation. Ask the Du Pont Explosives representative in your district for complete information about "Monobel" AA. E. I. du Pont de Nemours & Co. (Inc.), Explosives Department, Wilmington 98, Delaware.

DU PONT
PERMISSIBLES
Blasting Supplies and Accessories

DU PONT
REG. U.S. PAT. OFF.

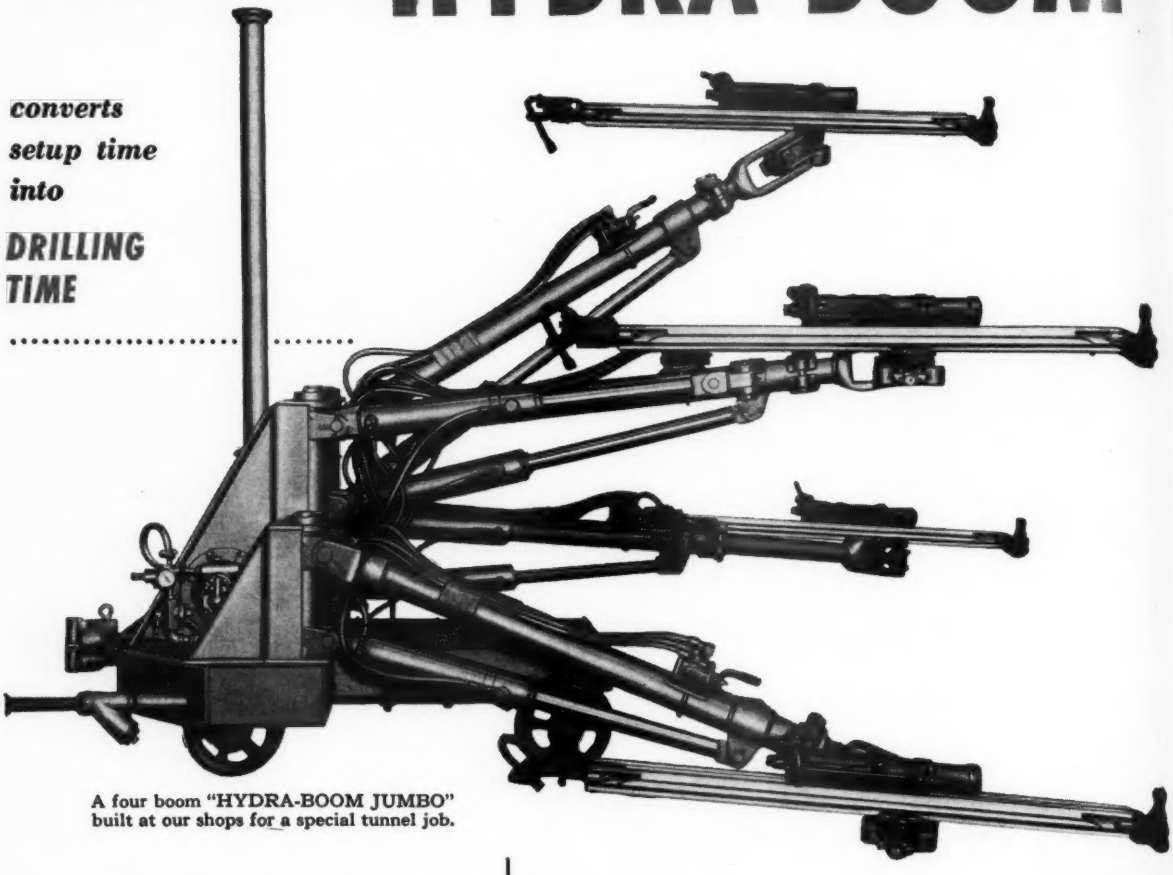
BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

A more powerful, faster-acting, boom jumbo

INGERSOLL-RAND HYDRAULICALLY-OPERATED

THE NEW HYDRA-BOOM

converts setup time into **DRILLING TIME**



A four boom "HYDRA-BOOM JUMBO" built at our shops for a special tunnel job.

Only HYDRA-BOOM has these advanced design features

1. LARGER PISTON ARM CYLINDERS for lower oil pressure and longer packing life. They will handle longer and heavier drill feeds.

2. DOUBLE ACTING HYDRAULIC CYLINDERS permit mounting under deck as well as top side because boom operation is not dependent on gravity.

3. EXTRA LONG PISTON ARMS give unmatched stability.

4. LOWER OVERALL HEIGHT for lower headroom clearance.

Four new design features plus individual built-in oil reservoirs make the HYDRA-BOOM the outstanding hydraulically operated drill mounting of today. All HYDRA-BOOM movements, including the ceiling jack, are controlled by an air motor driven hydraulic pump — no hand pumping is ever necessary. And in addition, the hydraulic system is kept under constant pressure to insure instant and positive control at all times.

Simplicity of design, low height and built in hydraulic oil reservoirs permit the mounting of one or more HYDRA-BOOMS on practically any kind of Jumbo that may be required. A two-boom car mounted HYDRA-BOOM Jumbo is standard but let us quote you on special rigs to suit your individual requirements. Optional extendable hydraulic booms are available for use on jobs that require greater face coverage.

The new I-R HYDRA-BOOM may mean important savings for you so be sure to get the complete story from your I-R representatives without delay.

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5-52

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Editorials

JOHN C. FOX, *Editor*

MAY, 1954

Tax Revision

AS THIS issue goes to press, the Senate Finance Committee is holding hearings on the Revenue Revision Bill of 1954. This Bill, H. R. 8300, was introduced March 9 by House Ways and Means Committee Chairman Dan Reed and passed the House March 18 by a vote of 339 to 80.

At the start of the Senate hearings Treasury Secretary Humphrey asked the Senate Finance Committee to approve the bill as a step toward correcting what he called "a messy and stifling national tax structure." The Secretary made three points clear about H. R. 8300:

It is designed as a tax reform, not a tax reduction bill.

It will help millions of taxpayers who have wrestled with unfair and unjust hardships for a long time.

It will help our economy to grow by helping new businesses to start; older businesses to expand, and all businesses to modernize—with new and better jobs for many, and "better living for everyone."

H. R. 8300 represents more than a year's intensive work by the tax-writing Committees of Congress, the Treasury Department and numerous advisory groups. It is based on the testimony of more than 600 witnesses plus some 15,000 suggestions from individual taxpayers.

How does this bill affect Mining? Obviously, there is not room here to discuss every provision bearing on the mineral industries. Some provisions, however, are of special interest to mining men.

Changes in percentage depletion include liberalization of the allowance in certain respects and its extension to additional minerals; a definition of what constitutes a "mineral property" which makes it clear that separate mineral interests making up an operating unit may be aggregated in computing percentage depletion; allowance of percentage depletion to mine owners for minerals recovered from dumps and tailing piles; and additions to the definition of "gross income."

The bill would also permit net operating losses to be carried back two years and forward five, thus allowing a total of eight years for spreading a loss. It partially removes the existing discrimination against mining taxpayers with some years of loss and some years of profit, under which percentage depletion has been denied both in the loss year and the years to which the loss is carried.

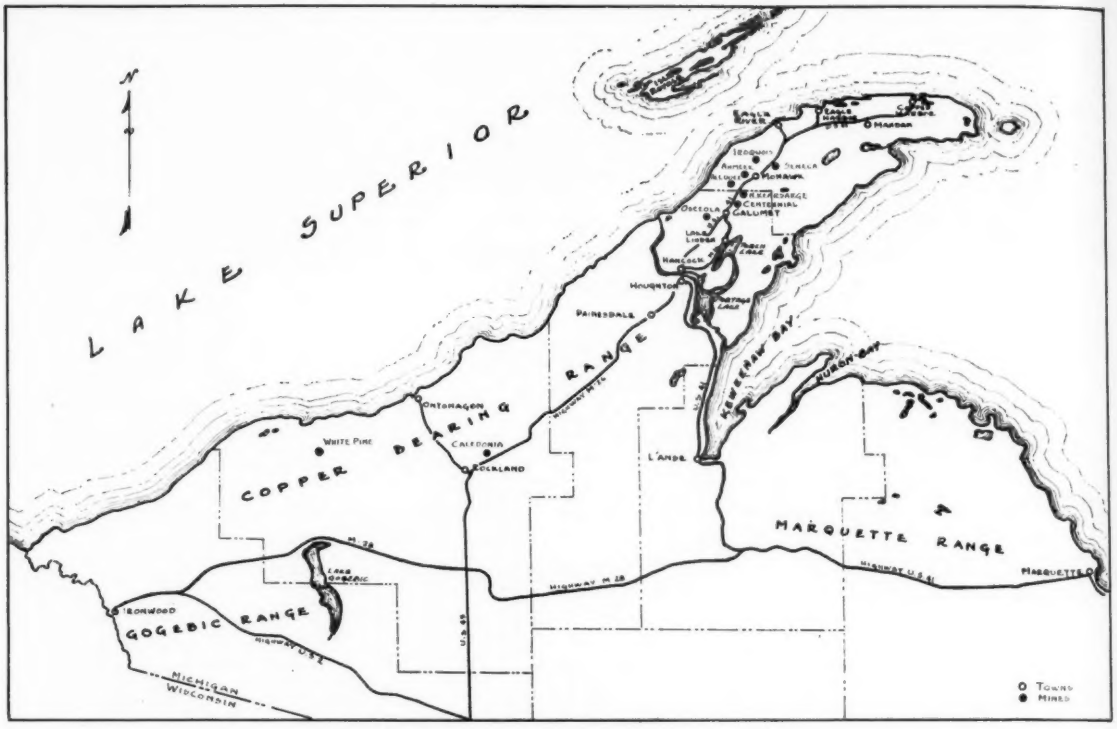
The bill provides a start toward eliminating double taxation of dividends, thus affording a greater incentive for investment which will provide production and employment.

It provides more liberal depreciation allowances, through use of the "declining-balance" method at an initial rate up to twice that available under the present law's straight-line method. The taxpayer may also use any other method that produces a deduction no greater than the declining balance method.

Cost of research and experimental projects may be deducted as current business expense.

The bill would bring tax laws into line with generally accepted accounting principles, and in the words of Chairman Reed, "it includes a rearrangement of provisions to place them in a more logical sequence, the deletion of obsolete material, and an attempt to express the Internal Revenue laws in a more understandable manner."

These are but a few of the changes that affect the mining industry. H. R. 8300 is far better than many felt possible considering the magnitude of the task that faced its framers. Many points in the Bill should no doubt be revised and clarified before its adoption, but on the whole it is a long overdue improvement in our Internal Revenue laws, and should be enacted.



Michigan's Upper Peninsula, the "Copper Country"

Recent Drilling Trends At Calumet & Hecla

Careful Tests and Comparison of Equipment Increases Output, Decreases Costs. Greater Improvements Ahead

By COLIN A. CAMPBELL
Manager of Mines
and
ROBERT W. VAN EVERA
Production Engineer
Calumet and Hecla, Inc.

RESULTS of Calumet & Hecla's program for testing drilling equipment justifies relatively major changes from present practice. In this respect, this company is following the trend set by other companies that have published results of test work in the past. This may, therefore, sound like the same old record. Even so, this report will re-emphasize the great progress being made in drill practices today.

First, a word on the geology and mining method at Calumet. The C. & H. copper mines are located on the Keweenaw Peninsula of northern Michigan. In the Keweenaw series there are hundreds of basaltic flows which total several thousands of feet in thickness. Interbedded with the flows are felsite conglomerates, which occur more abundantly in the upper and lower parts of the Keweenawan. The ore deposits lie within the central portion of the series, which consists chiefly of lava flows. The beds dip to the northwest at about 38° and flatten slightly with depth. At the present time, most of the mining is done in the amygdaloid lodes. Native copper, with a minor amount of silver, is the ore mineral and is found in the amygdules along with many secondary silicates and carbonates. The rock is hard and dense, but not highly abrasive.

Recovery 95 Percent

The mining method used is open overhand stoping. Widths of stopes vary with depth and ground pressure from 20 ft to 38 ft between pillars. These "rib pillars," as we call them, are about four ft wide, and are divided into sections by holes about every 20 ft which allow ready access between stopes and free movement of air currents. The level intervals vary from 150 to 200 ft, and average thickness of the lodes is 8½ ft. Stopes are generally retreating toward shaft pillars; hence, the timber required in the stopes is negligible. Actual total recovery is approximately 95 percent of the commercial ore.

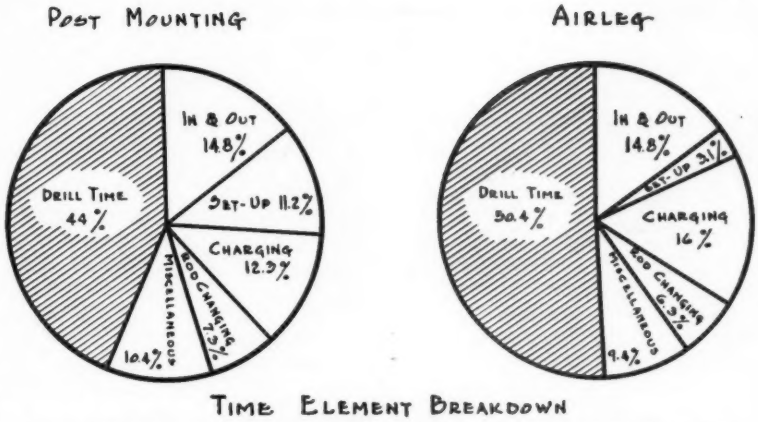
Test Light Drills

Heretofore, drilling in the stopes has been done with three-in. drifters, and in the drifts 3½-in. drifters were used. These machines are all tappet construction. Drill steel has been one-in. hexagonal and ⅞-in. quarter octagon section fitted with the one-use steel bit throughout. In 1947, exhaus-

tive tests were made with various types of bits, and from these tests it was decided to switch to the one-use steel bit from the multiple-use steel bit. The one-use steel bit had a better penetration rate and reduced transportation and nipping charges, with resultant lower costs per foot. Installation of the one-use steel bit raised the problem of bit removal from the rod, but this problem was licked as the miners gained experience.

C. & H. operators have wanted for some time to replace the heavy drifters and the post mounting with a lighter drill which would give greater mobility and flexibility. A number of times, over the past seven years, short tests were made to determine the feasibility of using airleg equipment. Each time the results appeared the same: loss of penetration speed, inability to drill in mass copper, and difficulty in handling the equipment on an incline of 38°. However, about a year ago, a drill manufacturer asked permission to put on a demonstration and generally favorable results prompted us to set up a large-scale test. Improved drills, rods, and bits demonstrated by exceptionally good machine operators, made it clear that our original interest in airleg equipment had been sound.

The test program was set up in a section of one of the mines where the rock is harder than normal and where mass copper is encountered. A number of different airlegs were placed in use and the miners were trained by the various demonstrators. When the miners were properly trained, the demonstrators left the mine, and we proceeded to find out what our men would do on this equipment. Information gathered from the test was: penetration speed, feet drilled per miner shift, tons broken per miner shift, maintenance of equipment, and miner acceptance. In addition to the test set up in a stoping area, we tested airleg equipment in a drift. Along with the testing of various makes and sizes of airleg drills, we are in the process of selecting a drill steel and bit.



Time Element Breakdown

More drill time and greater penetration rate with airleg drill means 30 percent more footage per shift

Results Encouraging

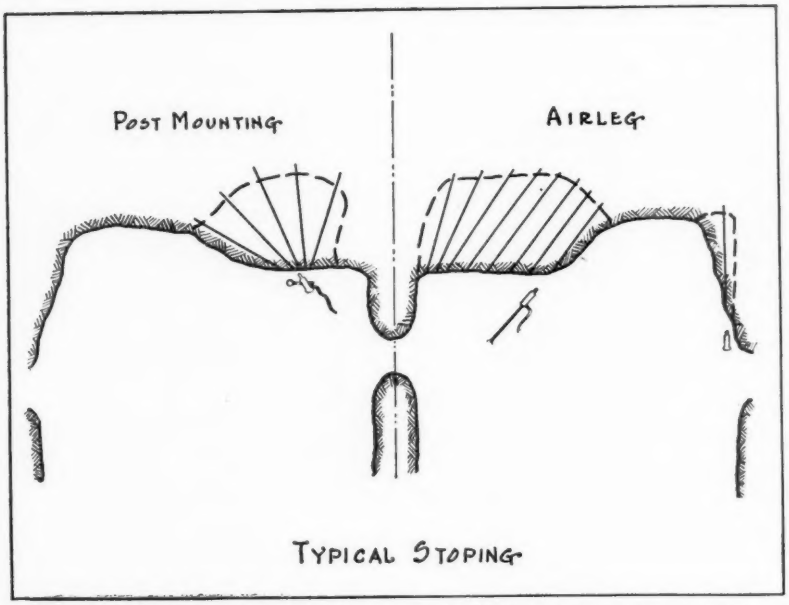
Seven stopes began operating with various makes of airleg equipment about the beginnng of 1953. Piston diameters varied from 2½ to 2 15/16 in. Airleg equipment has now replaced most of the three-in. drifters for stoping in our mines, and it is possible to give the results of the test. With the post, time required for set-up averages 30 min. and tear-down averages 15. Airleg equipment can be set up and torn down in less than one quarter of this time, thus giving additional time for drilling. Often a post set-up allows the opportunity to drill only six holes, and it is very seldom that supervisors have been able to get the miner to set up a second time in a shift. With airleg equipment, this difficulty has been eliminated due to the ease of moving the equipment. Drilling from a post requires "fanning" the hole by placing a light burden on the collar and a heavier burden on the point. With greatly varying conditions, this requires a higher degree of skill and judgment on the part of the miner than does airleg drilling, where holes of much more even burden are possible. Since our incentive pay system is based on feet of hole drilled per shift, the difficulty of eliminating light holes becomes a problem to supervisors. The answer, of course, is training both supervisors and miners.

The following figures give a general idea of results. A miner can increase his total footage by 45 percent and thereby almost double his incentive earnings by switching to airleg equipment, and the miners participating in the test work did that. However, because above-average miners were assigned to the test work under close supervision, this figure dropped to about 30 percent footage increase when an entire mine was switched over. Average incentive earnings are still in the area of 60 percent above what they were with the post.

Until recently the post mounted drifter was more effective than any proposed replacements

Outperform Older Drills

During the test, the tons per miner shift were doubled, but, again, as expected, this figure dropped somewhat in routine mining. The test results pointed out that a much more effective hole can be drilled with an airleg where the angle of the hole is not regulated by a post. The average penetration rate is slightly faster



Uneven burdens on holes drilled with post mounted drill compared to uniform burden when airleg drill is used

with the airleg than with the three-in. drifter for several reasons: The hole is smaller; the tungsten carbide bit stays sharper; and the airleg tested was new compared with a three-in. drifter that was somewhat worn.

Drifts are 9 by 12 ft. in cross section. A horizontal V-cut is drilled using 36 holes. Two men drill and blast on one shift and one man mucks out on the other shift to make an average advance of seven and one-half ft per cycle. It did require the whole shift to drill the round using the 3½-in. machine. Using the airleg drill with a ⅞-in. hexagon intraset steel, the miners have been able to drill a deeper cut and still finish drilling earlier than before. Reduction of hole diameter has effected slightly faster penetration and has reduced powder consumption, with no adverse results. Considerable time savings result from the reduced rigging-up operation and the elimination of bit changes during the shift. Drill holes are smaller requiring the use of smaller diameter powder, which has meant a 20 percent reduction in powder costs. It has been possible to maintain the same strength powder with equal effectiveness. Air consumption is cut in half. Needless to say, all drifts have been converted to airleg equipment.

At first, the drift miners sharpened their own steel with a portable grinder underground. However, with the average miner, this was not a good policy, as the rods did not get the proper attention, and high steel costs resulted. They now use detachable bits which they bring to surface daily for sharpening, if needed.

Maintenance on the airlegs has not been as favorable as hoped. Front-end parts wear faster, which can be expected due to the misalignment of the drill rod. Costs of airleg parts are lower than three-in. drifter parts; thus, we can afford to replace parts oftener, but it has been necessary to watch maintenance costs closely. As a result, we have insisted upon some design changes adjusting to local conditions. We can also expect to replace the airleg machine oftener but, again, with an original cost of a little more than one-half that of a drifter, we can afford to replace oftener.

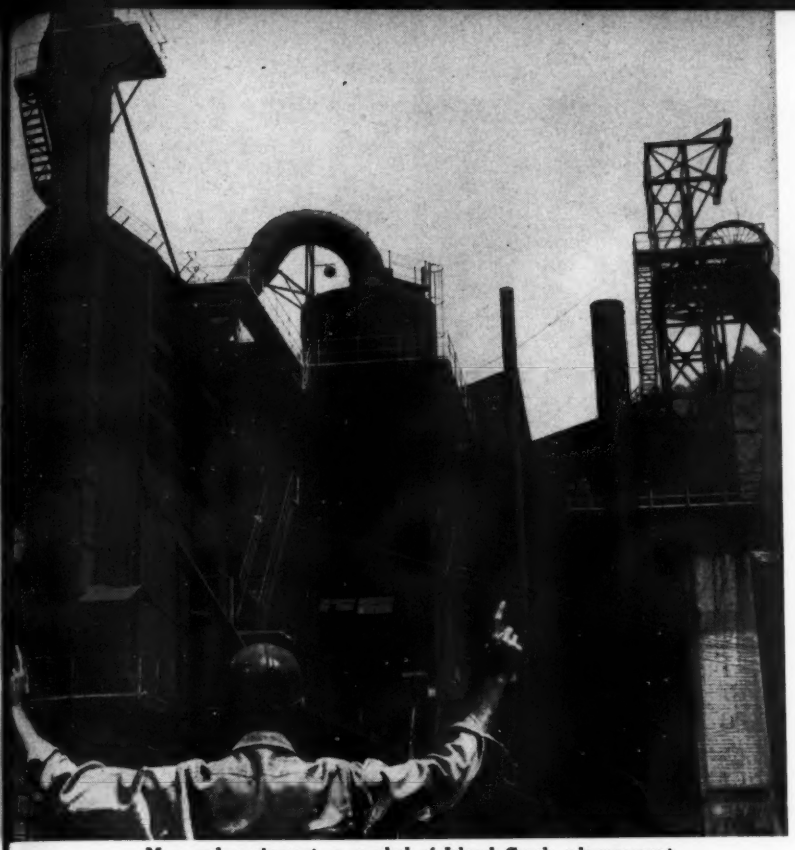
Miner Training Vital

Miner acceptance, as always, is a problem. To minimize it, conditions at each test drill were given careful consideration to avoid letting a miner "bog down" due to lack of initial instruction or proper equipment for his work place. Complaints were registered on various machines such as: miner getting wet when drilling up holes; difficulty in changing water tubes; poor location of exhaust port or control handles; not safe, and too much work. The main complaint, getting wet, has been partially solved by protective clothing and water deflectors. Most of the other complaints tend to die out as the man gets broken in. The best answer to miner resistance is training, with each man being given individual instruction until he is well broken in.

Tests have been run on carbon steel compared with chrome alloy steel. Results thus far indicate better costs with chrome alloy steel, which is priced 15 percent higher than carbon steel. Steels are still being tested and experiments with fabricating methods being made. Final preference is reserved pending results. The advantage of greater pliability before permanent bending of alloy steel was immediately apparent. Alloy is much more difficult to fabricate than the old carbon, and elimination of one weakness merely led to the next. However, alloys are giving respectable perform-

(Continued on page 79)

Miners liked new equipment after they found they could increase their pay with less physical effort



Men and equipment, a symbol of Island Creek advancement

The Island Creek Story

An Industry Leader Celebrates Golden Anniversary

By GEORGE W. SALL

"Great works are performed not by strength, but by perseverance." — Samuel Johnson.

"WHAT do you think of Island Creek Coal Co.?"

When a well known consulting engineer was asked this question recently, he answered, "One of the best managed and most profitable companies in the industry." This is high praise indeed.

How has Island Creek achieved this record in a business that is always competitive and sometimes worse—one that is not historically known for the financial success of its members? To learn what had made the Island Creek Coal Co. one of the leaders in American industry, let us go back and trace its growth.

Island Creek, strange as it may seem, had its beginnings in an oil company. On September 25, 1895, the Boston Petroleum Co. was organized in Boston, Mass. Six days later, for some now unknown reason, the company name was changed to the United States Oil Co.

From the company's organization until 1902 its activities were confined strictly to the oil business. It held 17,000 acres in northwestern West Virginia and southeastern Ohio. On this land were 341 producing oil wells and two producing gas wells.

One of the directors of the United States Oil Co. was a William H. Coolidge, later to become chairman of the Board of Directors of Island Creek. He was also actively connected with United States Mining Co., a metal producing company operating in the West.

Let us leave Coolidge for a spell to meet another important personage in Island Creek history—Albert F. Holden. Holden was an Ohioan by birth and an engineer by training and profession. His father was publisher of that great metropolitan newspaper, the *Cleveland Plain Dealer.*

Two Men Meet

Holden was graduated from Harvard seven years after Coolidge and went to Utah as a mining engineer. While there he acquired a metal mine that was in sad shape profitwise, and put it on its feet. However the ore began to run lean and Holden started to look for a purchaser. He approached the United States Mining Co., with which Coolidge was actively associated, and eventually sold the mine to them.

It is said that after the sale was consumated, Holden asked Coolidge why the mining company bought his mine. Coolidge then told him that they were not so much interested in the mine output for its metal content as they were in using the ore as a flux at their Midvale, Utah, smelter.

The date of the above transaction is unknown and unimportant, but the transaction is important because it brought Coolidge and Holden together. Holden joined the United States Mining Co. and by 1902 was its managing director. He was then 35.

Now back to the United States Oil Co. The first few years of this company's operations were successful but by 1901 it had become apparent, to at least some of its directors, that something would have to be done to keep the company sound. The decision was then made to diversify. Just when this decision was made is unknown but in a report to stockholders in May, 1902, the following statement was included:

"They (the company directors) believe now, and for a long time have believed, that it would be advantageous if some more permanent commodity than oil could be added to the business of your company, and, as its charter provides for the production of coal as well as oil, your Directors have for nearly a year been searching for a coal property of such prob-

Mechanization extends to the warehouse also

able earning capacity as would warrant its acquisition by this company."

Some or all of the directors of the United States Oil Co. had financed, on their own, an investigation of coal lands and the acquisition of any coal properties that looked promising. This association then directed Coolidge to make the investigation and he in turn selected his close friend Holden to accompany him.

In the summer of 1901, Coolidge and Holden traveled into southern West Virginia looking for coal. The holdings of James A. Nighbert of Logan were shown the two men by Colonel Z. T. Vinson of Huntington. Vinson was a lawyer and, like many of his profession, participated actively in the development of coal lands. He was also a close relative of the late Supreme Court Chief Justice Fred M. Vinson.

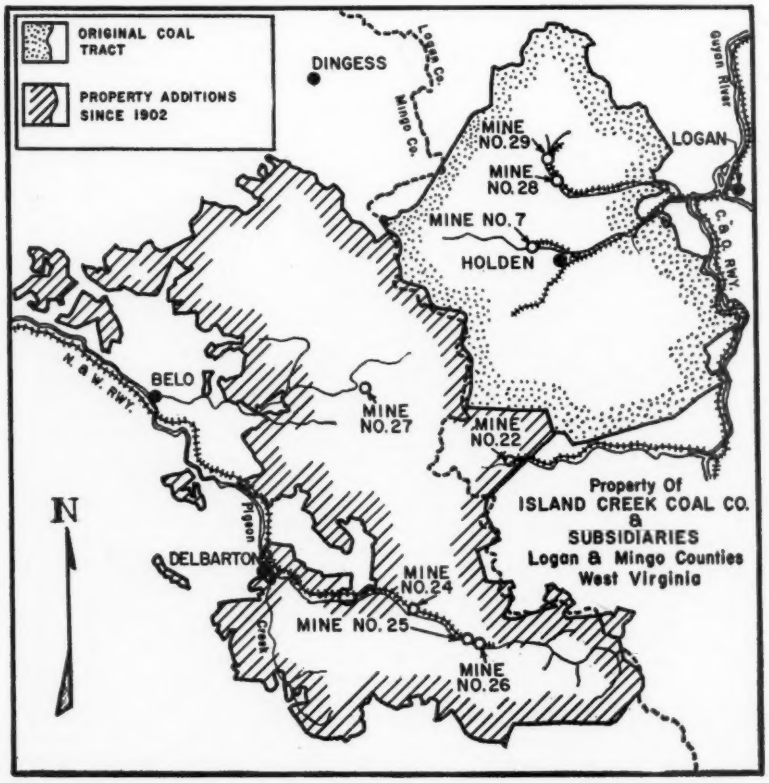
Coal Lands Bought

As a result of their investigation, 28,000 acres of coal land were bought by Holden and Coolidge representing the Boston group. The company that purchased the coal land was a holding company only and was called the Island Creek Coal Co. of West Virginia, taking its name from the small, muddy creek that ran through the area. Holden was managing director of the company and Col. Vinson was one of the directors. In the report to stockholders made in May, 1902, and referred to earlier, it was also announced that Holden and Vinson had been elected directors of the United States Oil Co.

At the time the purchase was made, the area had a population of less than 100 and in all of Logan County there were only 6955 souls.

On June 2, 1902, the stockholders of the United States Oil Co. authorized their Board of Directors to purchase the stock and property of the Island Creek Coal Co. of West Virginia and the name of the company was changed to the United States Coal and Oil Co. At that time it was estimated that $500,000 cash would be sufficient to equip the coal company for an annual production of 2,000,000 tons. The dollar must have really been worth a dollar then.

The company continued to produce oil but by 1904 decided to dispose of all oil holdings. By early 1907 this was accomplished and the company's mineral interests were entirely with coal. Selection of the original Island Creek holdings was an excellent choice by Holden and Coolidge, In an area with less than 100 inhabitants, and after an inspection that would be cursory by present standards, they bought the choicest part of a good coal seam. The Island Creek or Cedar Grove seam, as it is sometimes called, averages six ft thick and lies in a saucer-like formation under Holden, W. Va. There are no partings in the seam and mining conditions are excellent. Dipping gently to the south the seam splits along a line roughly paralleling the Logan-Mingo county line into the upper and lower Cedar Grove seams. These are minable, but are not as thick, running between 42 and 65 in. thick.



Begin Development

Active development of the property began in September, 1902. One of the first activities was the purchase of a portable sawmill to enable a building program to get under way. Shortly thereafter a band mill was erected from which over 2,500,000 fbm of lumber was produced in the first year of operation. Houses, coal tipples and storage buildings were constructed. During this time, the town of Holden was laid out, a power plant built and grades were set for the construction of the Island Creek Railroad. The company furnished its own power until 1920 when they began to purchase it from outside sources.

At the time that Holden and Coolidge purchased the coal land they believed that the best railroad connec-

The Coal Company's Four Presidents

A. F. Holden
1902—1913

T. B. Davis
1913—1934

J. D. Francis
1934—1949

R. E. Salvati
1949—

tion could be made at Dingess, W. Va., with the Norfolk & Western. This would have necessitated the driving of a tunnel through a mountain, however, and by the time that the United States Oil Co. bought the coal property, the decision had been made to connect with the Chesapeake and Ohio Railroad instead. The Guyandotte Valley Railroad was then under construction to connect Logan, W. Va., with the C & O main line and the coal company would have to construct only about five miles of track to connect with the G. V. at Logan. One of the early company reports states that the decision to connect with the G. V. rather than with the N&W reduced the cost of the Island Creek Railroad by about $150,000.

The G. V. was completed for use on September 12, 1904, and the coal company finished a bridge to connect the Island Creek Railroad with it in early October of the same year.

While the railroad was being constructed, machinery and equipment was shipped to Dingess on the N&W and from there taken to Holden by ox team. This was a 12-mile haul and as many as 17 ox teams were used in the overland movement. Much of the route had to be corduroyed. After Holden was connected to the outside by rail, the oxen were used in the company's extensive timber operations.

Ship First Coal

In December, 1904, the first shipment of coal was made on order No. 1. It is the 50th anniversary of this first shipment that Island Creek is celebrating this year. That first order for coal was received from Charles E. Sholes Co. of New York for 10 cars of coal to be shipped to Indianapolis, Ind.

Coal company employes numbered 756 at the time. In 1905 production reached 147,703 tons and, according to a report of that time, only the supply of railroad cars limited production. Nineteen eight was the last year in which production for Island Creek was less than 1,000,000 tons. By then the population on company property had increased to 3000 and Logan County had grown to 12,000.

Also in 1908 the company bought two river steamers, 100 coal barges, a railroad engine and 200 coal cars to develop a river trade. A railroad yard and coal tipple were constructed at Huntington, W. Va., and Island Creek was in business moving coal on the Ohio River. The railroad engine and 100 coal cars have long since been disposed of but the company now owns and operates through one of its subsidiaries a fleet of two modern towboats and 100 barges with an approximate capacity of 1000 tons each. Their railroad to barge unloading facility at Huntington has a capacity of 6500 tons per shift. An elevator and screening plant at Cincinnati, Ohio, has facilities for unloading barges, rescreening and reloading coal into railroad cars or trucks as needed.

The corporate name of the United States Coal and Oil Co. was changed to Island Creek Coal Co. in 1910. In 1912 the coal company began paying dividends to its stockholders. Since that time not one has been passed by.

Longwall mining experiments have made the company enthusiastic about its application in certain areas

Men and Progress

No company is any better than the men who direct it, and Island Creek has been blessed with good leadership since its conception. A. F. Holden we have already discussed. He was Island Creek's first president and held that office until his death in 1913. T. B. Davis followed Holden as company president. Davis was a West Virginian by birth and entered the coal business immediately after graduation from Yale. He had participated in the organization and operation of several coal companies before joining Island Creek in 1907 as a vice-president. Davis served as president from 1913 until 1934, when he succeeded W. H. Coolidge as chairman of the Board of Directors, a position he held until his death in 1948.

In 1911, a year after Island Creek took its present name, James D. Francis became associated with the company. He was first retained as counsel and was elected a vice-president in 1918. In 1934 he succeeded Davis as president, and became chairmain of the Board in 1949. He retired from the latter position in 1952 and in March 1954 resigned as director of both Island Creek and Pond Creek Pocahontas.

Another West Virginian, Raymond E. Salvati, now heads the company. After receiving his degree in mining engineering from West Virginia University in 1922, Salvati joined the Island Creek Coal Co. as trackman at Mine 16 on Mud Fork. He was promoted to mine foreman within a few months and to superintendent over five mines in 1924. He transferred to the Pond Creek Pocahontas Co. as superintendent of Mine No. 1 in 1926. He was appointed manager of this company in 1928 and four years later was elected a vice-president and director.

In 1935 Salvati was transferred to Island Creek Coal Co., although retaining his status with the Pond Creek Pocahontas Co. In 1936 he became general manager of Island Creek; in 1940, a vice-president; in 1942, a director; and in 1949, president.

These men and the men with whom they surrounded themselves are responsible for Island Creek's great record. In the first half century of operation the company has produced over 273,000,000 tons of coal. This is just over 60 percent of the bituminous coal production of the entire country last year. If it were moved by a single train, that train would be 33,000 miles long and would require 23 days to pass a given point at a speed of 60 mph. Property has been acquired steadily so that reserves today are greater than the tonnage already marketed and can support an annual production of over 10,000,000 tons.

Mechanization Developments

Island Creek has historically been a conservative company. They have very few firsts in the industry as far as mine mechanization goes. However, whenever a mining machine or mining method has proved its value they have taken advantage of the improvement in a direct and immediate manner. A good example of this philosophy is their experience with mechanical loading.

Until 1935 Island Creek mines operated on a hand loading basis. Shortwall cutting machines and power drills were installed in 1920 and '21, but loading was still by hand. Studies showed the advantage of mechanical loading in 1935 and the company began to install loading machines. The mechanization program was completed in 1937. This was a remarkably short time when one considers the number of mines affected and the problems which had to be solved to make such a change.

As early as 1929 the company operated a cleaning plant. In that year a Roberts and Schaefer Hydroseparator was installed at No. 22 mine to clean the 2-in. by ¼-in. nut coal. With the advent of mechanical loading the coal cleaning problem increased and in 1936 Island Creek began a program to clean mechanically all coal mined by the company. In 1939 this project was completed. Because of the topography of the area and the geographic location of the mines, it was decided to locate cleaning plants at each mine instead of using a central plant. These plants have been improved constantly as technology advanced and together with newly constructed plants continue to supply company customers with a uniform product of consistent specifications.

Before any new piece of mining equipment is bought or put underground, it is thoroughly studied. By the time it is placed on a section the mining department has a good idea of what should be expected from the machine and standards are set up for its performance. These standards are kept under constant review and are revised as mining conditions change. A six to seven-man industrial engineering department is maintained to study all factors affecting production and equipment.

Continuous mining has not yet been adopted although various machines and methods are under study. The present philosophy of the company, as far as mechanical mining is concerned, is to go completely to off-track mining with conventional equipment. Only older sections with short life will remain on track.

There is one method of mining in which Island Creek is currently doing some pioneer work in this country. It is studying longwall mining and has a fast-planer type machine in operation at one of its properties. Although all of the results are not yet in, the company is enthusiastic about its application in certain areas.

This then is the Island Creek story. The oil company that sought a more permanent commodity than oil has produced more than 273,000,000 tons of coal—energy, heat and power for America through two World Wars and several financial crises.

Since 1908 Island Creek has been shipping coal on the Ohio River

The Star Mine is a zinc-lead-silver producer at Burke, Idaho

Geology in Ore Delineation and Extraction

Every Tool of the Mining Geologist Is Utilized in Planning For Complete Ore Extraction at Leading Idaho Mine

By ROBERT E. SORENSON

Vice-President,
Chief Engineer and Geologist
Hecla Mining Co.

ALTHOUGH at the present time all possible uses of geology are employed by operators of aggressively well-managed mining companies it is only a short time ago that the "leather-legged rock hound" was almost universally ignored in operations which often were in the capable hands of the old style mine captain whose nose for ore often appeared to be, and often was, most uncanny. No reflections should be cast upon the old time mine captain and certainly will not be by me for I have spent more than 25 yr examining mines and prospects where pickings look very thin where he has cleanly mined and thoroughly explored many of the old properties in the west. His methods were based upon a good memory in relating present work to previously unmapped mine openings and, whether he will admit it or not, usually he was using geological methods acquired through experience.

Ore bodies are becoming more difficult to find and the geologist is almost essential in discovery of mine ore bodies and in present day mining involving high costs of exploration and increased costs of ore extraction. It is becoming necessary to use every method at our command to find ore cheaply, to mine it economically and to extract the last available ton of commercial ore in the mine. Each operation has its individual problems connected with structural controls of ore shoots, size, shape and attitude of ore bodies, wall rock characteristics, alteration halos and other geological phenomena, together with costs and problems involved in ore extraction, which must guide the geologist and engineer in selection of methods to be applied.

Each mining operation of relatively long standing obtains its current methods from an evolution through stages involving the application of ideas of many men. The finger can seldom be pointed to the man who did it. Because all operations have peculiarities of their own, universally adaptable methods cannot be described. The attempt will be made to explain application of geological and engineering work to the Star Mine, with short references to other properties.

The Star Mine is a zinc-lead-silver producer located at Burke, in Shoshone County, Idaho, and owned by Sullivan Mining Co. which is jointly and equally owned by Bunker Hill and Sullivan Mining and Concentrating Co. of Kellogg, Idaho and Hecla Mining Co. of Wallace, Idaho. Hecla manages the mining operations of Sullivan and Bunker Hill manages the electrolytic zinc plant which is owned by Sullivan and located near Kellogg.

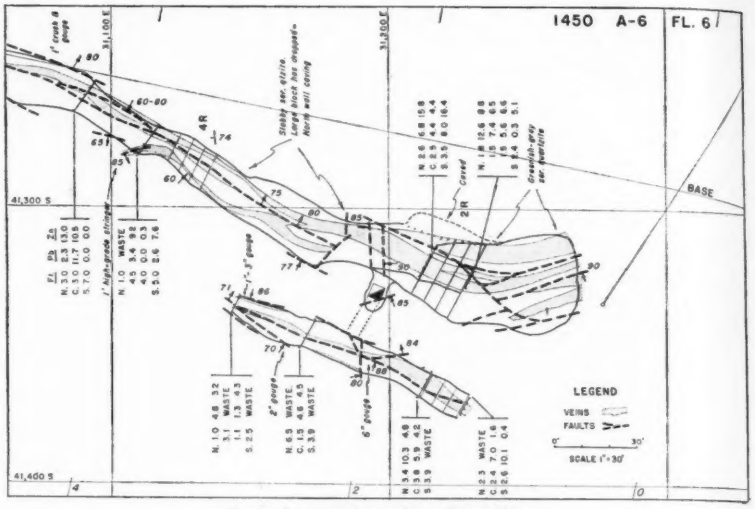
Deepest Lead Mine

The Star ore bodies are located on the Star-Morning vein system which is a broad almost vertical dipping easterly-westerly lode containing several branching fissure veins and several faults of considerable magnitude. The Star mine is located on the west-

erly portion of the veins and is adjacent to the Morning Mine of American Smelting and Refining Co. and separated from that mine by a common end line. In the two mines the lode has been explored and mined over a maximum horizontal length of 4000 ft and in the Morning mine through a vertical range of about 6500 ft probably making the Morning the deepest lead mine in the world. The Star Mine has been explored through a vertical range of about 5000 ft to 5500 level and will shortly be explored on 6300. The veins are largely mineralized fissures which cut through steeply dipping quartzite and argillaceous quartzite of the St. Regis, Revett and Burke formations of Pre-Cambrian age. Minerals of importance are sphalerite, galena, tetrahedrite and pyrite with minor quartz, siderite and barite as gangue minerals. Considerable replacement of wall rock is common and bleaching and sericitization of the wall rock is prevalent in a broad area along the vein system. Lamprophyre dikes crosscut the vein system at intervals and in the upper part of the Star mine a few dikes approximating dacite in composition occur in the westerly part of the mine. The latter appear to be pre-mineral in age although the lamprophyre dikes are definitely post-mineral in age.

Drive Long Crosscut

The mine was explored by Sullivan from the Hecla shaft at Burke through a 9000-ft crosscut which is the present main haulage level, and in the Star mine is known as the Star 4000 level. The main vertical Star shaft services levels from the 1000 to 4000-levels and a vertical offset winze has been sunk from the 4000-level to the 6300-level. The vein system has been stoped from 2900-level to the 4700-level and active stopes now are located in the sections from the 1000- to 2900-levels and from the 4700- to 5500-levels. Generally about 25 active stopes are mined. Stopes vary in width from five to 50 ft and average 10 to 12 ft.



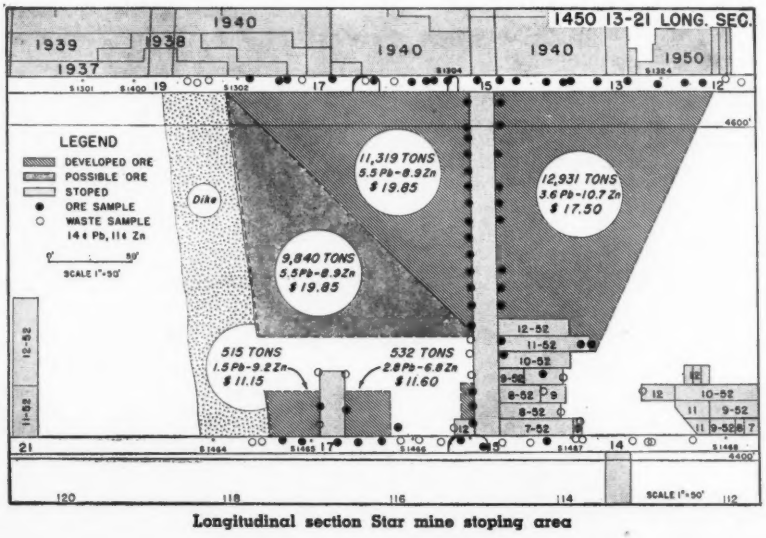
Typical stope floor plan—Star mine

Recognizing that a definite "cut-off" grade for ore mined is applicable generally to only a few of the active stopes in a mine, present cost data in the Star mine, which is a revision of older methods by R. W. Neyman, the general manager determine actual costs in each stope. Costs in individual stopes are affected by method of mining, width of ore, character of the ground, hardness of rock and several other factors, hence the cutoff grade of ore in any selected stope may be much different than in some other stope, even nearby on the same level. Careful studies of the literature on the subject is not of great aid. So many variables enter into the determination that the subject may have been carefully side-stepped by authors. In Star accounting, for cost and grade control, careful determination is made of individual stope costs each month and the record on each stope is carried through the life of that stope on cost sheets prepared by the manager's office. The details of these determinations would be the subject of an excellent article of considerable length but cannot be treated here.

Sample Each Car

To determine the grade of ore coming from each stope, muck samples are taken by the motorman or swamper from each car pulled from a stope and the sample is deposited in a steel container which is made by cutting a 55-gallon drum in two. By checking train reports the muck sampler determines when a particular sample will be ready for him, whereupon he cones and quarters the sample to approximately 10 lb. and sends it to the assay office noting on his muck sample slip the particulars concerning it including the amount of ore it represents in terms of standard cars. The sampler cleans up all samples at the first of the month and the samples are calculated to obtain a weighted average grade of production from the stope. Every month, some 300 muck samples are taken representing more than 20,000 tons of production. The muck sample tonnage is adjusted by taking into account the conveyor scale weights in the mill adjusted by the monthly difference in surface bin inventory. The tons mined are determined by taking into account the difference in the 2000 main ore pocket inventory and the adjusted tons hoisted. The car weight factors are then determined and applied to cars pulled from each stope thus determining the tonnage from each stope to which the sample grade applies.

Monthly, the engineering office sub-

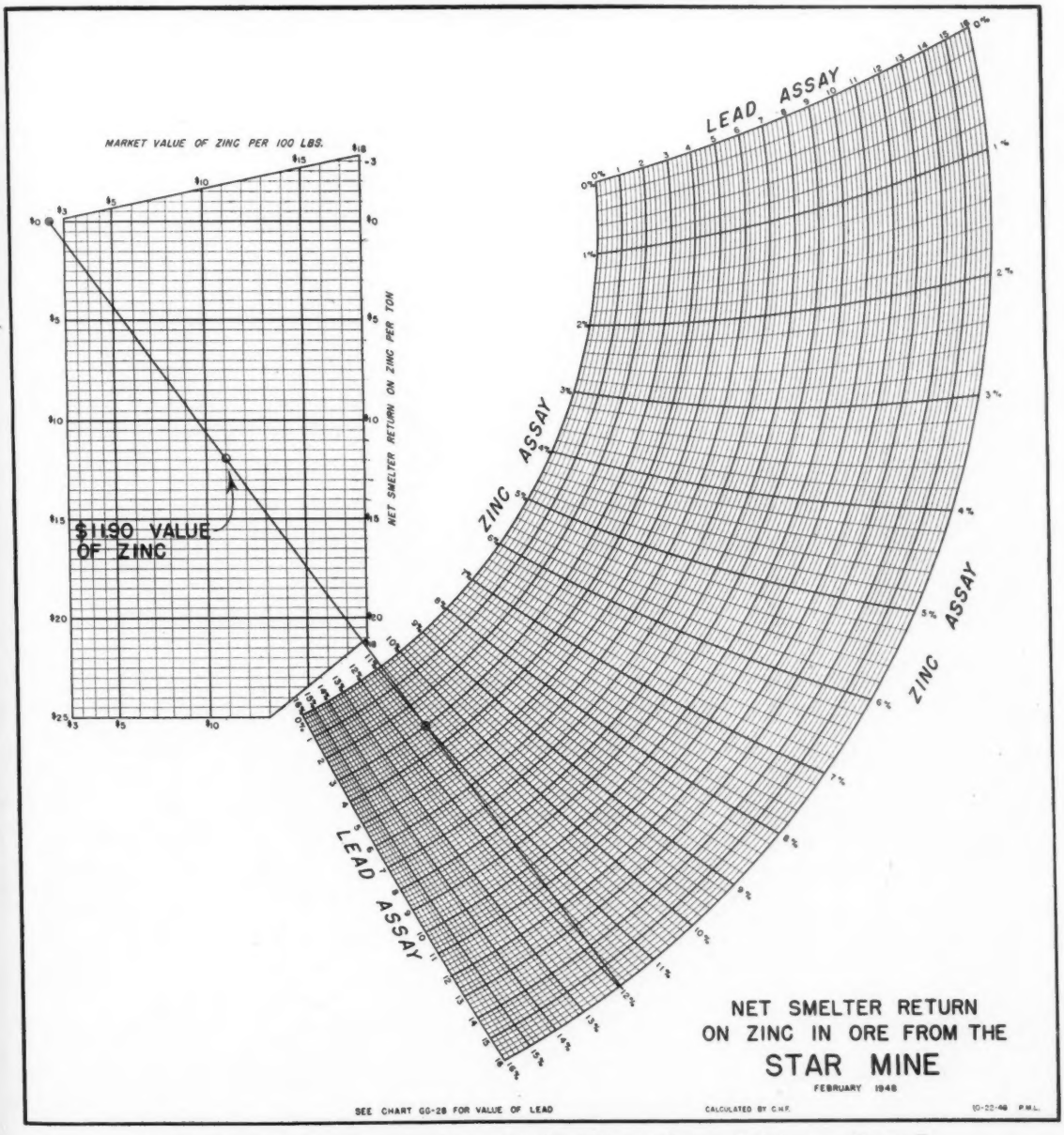


Longitudinal section Star mine stoping area

mits to the Manager's office a list of active stopes, drifts, and raises showing wet tons sampled, the grade of the ore in lead and zinc assay and the dollar net smelter return value which is adjusted by a moisture factor determined by daily moisture determinations of milled ore. The net smelter return value for the stope is entered in the stope cost sheets and compared with stope costs. Individual stope performance is shown on a stope cost summary sheet which is carefully reviewed in conferences between the manager, president, chief engineer and geologist and the comptroller in an attempt to maintain a satisfactory margin of profit in the operation. Questionable stopes are further studied by methods which will be described later in this paper. It may be of interest to note that the muck sampling results when compared to actual metal recovered and paid for during the year 1952 were 1.4 percent low on lead and 7.2 percent high on zinc.

Smelter Return Charts

In determining the net smelter return value of muck samples as well as daily stope face samples, the engineering and geology department uses a rather novel but very effective pair of net smelter return charts, one for lead and one for zinc. These charts apply for any price of the metals and for any combination of lead and zinc. They take into account average metallurgical results in the mill, smelter losses, freight to the lead smelter or zinc plant and smelting costs and they also take into account changes in smelter contracts which occur at certain metal prices. For a single combination of metal prices various types of charts are easily constructed and certain methods have been devised for determining cut-off grades by means of charts but several factors are ignored in most of them. In particular, although the Star charts take into account the "robbing" of one metal by the concentrate of the other metal (in

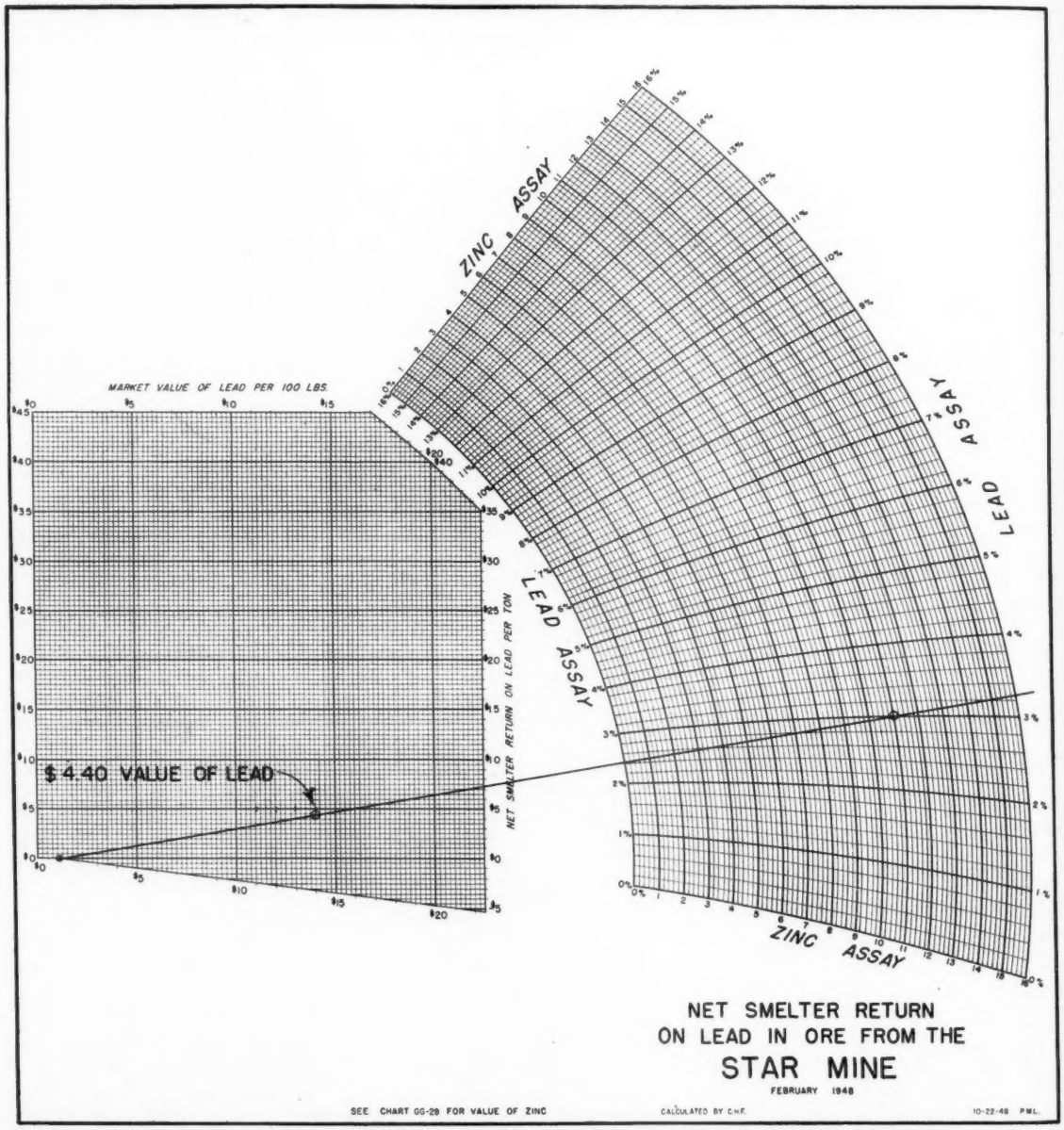


Dollar value of zinc in ore carrying 3 percent lead and 11 percent zinc when zinc was 11c per lb

some instances giving a negative value) other methods, which have come to our attention, ignore this. In most cases other methods do not provide for the change in smelter charges dependent upon metal price changes. In the case of the Star charts silver is allocated to the lead and zinc concentrates in proportion to its usual relationship to metal content of the concentrates and because of an almost constant silver-lead ratio in the Star mine a separate chart for silver has proved unnecessary. When metal prices change, the engineering office provides the operators with a sheet showing the combinations of lead and zinc necessary to equal the current average total cost of production of the ore through the milling stage. Another column of combinations of lead and zinc necessary to obtain a lower value represents the approximate average direct cost plus certain indirect costs. By referring to this sheet the operator may quickly determine the approximate category of stope or drift face samples or muck samples.

Charles H. Foreman, now retired but formerly chief engineer for Hecla, recognized the need for charts of this sort and in 1938-39 worked out the original involved calculations. R. W. Neyman, then an engineer for Hecla, constructed the original charts from the data calculated by Mr. Foreman. Some revisions have been made since, because of changes in metallurgy or other factors. Because these charts have proved so useful to us the methods used in their construction is included in this paper for the possible use of others who might be interested.

Use of the charts is simple. On the curved portion of the zinc graph select the point representing the assay in lead and zinc. With straight-edge aligned between this selected point and the vanishing point, indicated as a circle near the upper left corner of the chart (lower left corner on lead chart), the net smelter return value per ton due to zinc may be obtained when the straight edge intersects the



Dollar value of lead in ore carrying 3 percent lead and 11 percent zinc, when lead was 14c per lb

CONSTRUCTION OF STAR NET SMELTER RETURNS CHART

(1.) Average grade of lead and zinc concentrates and average milling results are determined for a year, or other suitable period.

(2.) Net Smelter return of the above concentrates are determined at prices of 5 cent and 20 cent lead with each price of 3, 5, 6, 8½, 9½ and 20 cents for zinc. (24 settlement calculations.) The 5, 6, 8½ and 9½ points are needed because of change at 5½ cents and 9 cents in the zinc contract. The net smelter return at various prices will indicate the value of the lead and zinc in each concentrate at each price. Silver is included in proper proportion as it occurs in the zinc concentrate and in the lead concentrate.

(3.) By using the following metallurgical formula, calculations are made at ore combinations of 4 percent Pb and 4 percent Zn, 4 percent lead and 20 percent Zinc, 20 percent lead and 4 percent Zinc and 20 percent lead and 20 percent Zinc. The calculation will give the percentage of weight of the ore going into lead concentrates, zinc concentrates and tailings.

FORMULA

Percent of weight of Mill Feed going into Zinc Concentrates:

$$\frac{(B-D)\ N \text{ minus } (B-C)\ O \text{ minus } (C-D)\ M}{(A-D)\ N \text{ minus } (A-C)\ O \text{ minus } (C-D)\ L}$$

Percent of weight of Mill Feed going into Lead Concentrates:

$$\frac{(A-D)\ M \text{ minus } (A-B)\ O \text{ minus } (C-D)\ L}{(A-D)\ N \text{ minus } (A-C)\ O \text{ minus } (C-D)\ L}$$

Percent of weight of Mill Fed going into Tailings:

$$\frac{(A-B)\ N \text{ minus } (A-C)\ M \text{ plus } (B-C)\ L}{(A-D)\ N \text{ minus } (A-C)\ O \text{ minus } (C-D)\ L}$$

Where:

	Assay	
	Zinc	Lead
Zinc Concentrates	A	L
Heads	B	M
Lead Concentrates	C	N
Tailings	D	O

(4.) By using the value and weight from (2) and (3) above, the dollar value will be obtained for each of the combinations in (3) at prices listed in (2) above. The total value of the lead in the lead and zinc concentrates at 20-cent lead is tabulated for each combination of lead and zinc at one percent increments from 0 to 20 percent. It will be noted that the lower percentages will have minus values because each concentrate demands some of the other base metal and because of tailing loss. Straight-line interpolation may be made on each sheet after four points are determined. In the case of 20-cent lead, those points are 4 percent lead, 4 percent zinc, 4 percent lead, 20 percent zinc, 20 percent lead, 4 percent zinc and 20 percent lead, 20 percent zinc.

Tabulations as above are made for 5-cent and 20-cent lead, and 3, 5, 6, 8½, 9½ and 20-cent zinc in the case of the Star ore.

(5.) The lead chart is constructed by first calculating the "vanishing point" which is the market value of lead at which any combination of lead and zinc will have no lead net smelter return value. This is a straight-line projection of the value of lead at 20 cents from a combination of ore assaying 20 percent lead and 20 percent zinc projected thru a value of lead at 5 cents for the same ore. Vertical lines are drawn at convenient intervals referenced to the "vanishing point" up to a convenient high price of about 25-cent zinc. Circular arcs are swung with the "vanishing point" as the center starting several inches beyond the 25-cent vertical "market value" and at ½-in. intervals so that there are 21 arcs representing zinc assays from 0 to 20 percent inclusive. Horizontal "net smelter return" lines are drawn across the vertical "Market Value" lines with the zero "Net Smelter Return" line through the "Vanishing point". Trial will show the proper spacing for 50-cent changes up to $50.00 "Net Smelter Return" value. Horizontal lines must be drawn below the zero line to indicate negative lead "Net Smelter Return" values where the lead assay is below tailing assay or an excessive quantity of zinc is present.

(6.) The Zinc chart is calculated similarly with "vanishing points" calculated at each 3 points because zinc plant contract varies at two zinc prices (5½ cents and 9 cents in the case of the Star ore). Points are plotted by ordinates calculated trigonometrically.

current market value for zinc and may be read on the left or right ordinate. The lead chart is used similarly and the combined results give the total net smelter return for the particular ore grade.

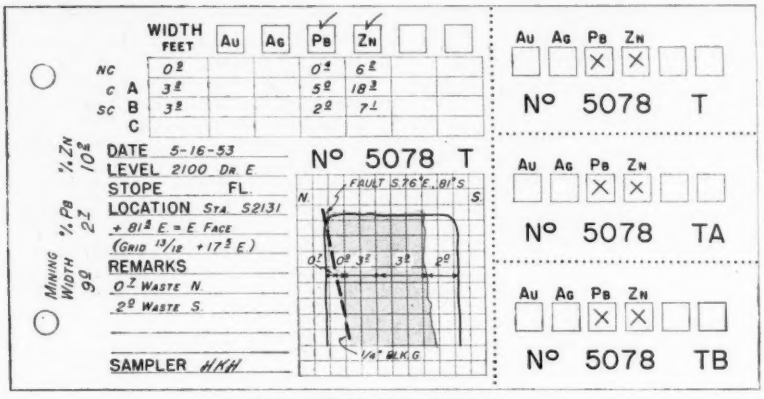
Basic engineering data in the Star mine all plotted on 50-scale on double mounted flat sheets 31 in. by 53 in. and vertical longitudinal projections of the stoping areas are plotted on similar sheets which show in appropriate colors stope advance each month and the width of stopes at 10-ft intervals. The mine is laid out in a grid system with a number allocated to each 50-ft segment beginning at the property line on the east. Level geology is mapped on 50-scale field sheets and plotted on a 100-scale tracing cloth folio. At 100-ft intervals, at alternate grid lines 100-scale vertical geological cross-sections are maintained up to date. This combination of maps gives a current three dimensional picture of the mine and expedites consideration of exploration and development plans. Annually, or when necessary, exploration and development work as planned by the department is submitted to the manager and mine superintendent on prints of the 100-scale geological level maps together with the reasons for such work shown in a memorandum covering each level. Later conferences determine the order of the work so that approaches will be made which coincide with requirements for waste in certain sections of the mine and logical methods of retreat in mining other levels.

Evaluate Reserves Yearly

Annually, but occasionally at other times of extreme metal price changes, the ore reserves of the mine are carefully calculated by use of factual drift, raise and stope sample data. All ore blocks in terms of developed, probable and possible ore are given in a complete tabulation showing tons, assay and contained units of lead and of zinc. The reserves are summarized by levels and by the areas above and below the 4000-level. Accompanying this tabulation is a development work summary of the preceding year and 200-scale vertical longitudinal sections showing all ore blocks in appropriate colors. The sections and tabulations are very helpful in considering the broader aspects of extraction problems. This annual reserve report is submitted to the president, the manager and the superintendent and of course serves the accounting department in tax matters concerned with ore reserves.

Map and Sample All Advances

Geologists map all drift advances and sample drift faces every other round or at intervals of about ten ft.



Face sample sheet—Star mine

Most raises are sampled at each end on each 10-ft floor. All faces are sampled in sections not exceeding six ft in width so that the samples of differing sections of the vein may be combined in any desired manner when using the samples for ore reserve calculations and when determining the mining approach. On a typical face sample sheet the extra tabs marked "A" and "B" are used for different sampled sections. On this sheet geology and appropriate notes indicate wall rock conditions, an aid in determining the waste dilution to be included in calculating ore reserves and in guiding the mining of ore. All sample slips show a colored geological sketch of the face sampled. Tabulations of mine samples are submitted to the manager, superintendent, shifters and chief engineer and geologist daily for guidance in advancing headings. These samples, together with daily muck sample results above described, serve the operation well.

For purposes of calculating annual ore reserve figures and to serve shift bosses and superintendent in stope guidance, sections of stopes are shown on 6 by 9 in. sheets covering associated areas of the mine and on the sheets are shown the current stope backs, raises and levels. Commercial samples are indicated by red circles and non-commercial samples by yellow circles. This sheet shows the ore blocks as the geologist believes they should be mined. Proper raise layout and stope planning may be done by study of these sheets.

Sections Guide Mining

In conjunction with the longitudinal sections just described the stope geologist maps geology of most of the active stope floors on 30-scale as they advance and he samples all stope faces of doubtful grade and those faces at the ends of stopes. Branching veins, dike areas and complex fault situations may then be followed through from level to level and the use of such maps and the associated samples serves as an excellent guide for clean mining. Brunton dip surveys on raise slide boards from level to level serve as the base points on each floor in raises to which the brunton floor surveys are tied. Between-level-information from these maps serves to fill gaps in the vertical cross-sections previously referred to and they are of great help in development planning and ore reserve calculation. This stope mapping and sampling consists of a great deal of dirty hard work and is not done in many mines because of this. Also the cost of the data is quite considerable and therefore the material must be currently used and must be presented to the operators at intervals suiting their requirements.

Changes in the character of the ore blocks in each area may be shown on the 6 by 9 sections when such changes appear in the mapping on stope plans. Recommendations in connection with individual stopes then are submitted by memorandum together with a map of the section involved. Changes in metal price structure often require a drastic change in methods in many stopes and such information is quickly supplied from the basic data available.

Explore By Drilling

A large amount of diamond drilling is done in the Star mine as laid out by the geologists. It serves well as a cheap method of exploring the walls of main drifts and for guiding exploration and development. In severely broken areas, drilling is done by plug bit taking pencil core with all sludge samples representing five-ft intervals being assayed for lead and zinc.

The geology department has charge of surface bulldozer exploration and mapping of many projects associated with Hecla Mining Co. and in the past has sampled large areas of the Coeur d'Alene District applying geochemical methods. Several exploration projects of Hecla, Sullivan, and Polaris Mining Co. are mapped and planned by our department. We also handled ventilation, safety and dust control problems and are prepared to do thin-section and polished-surface work in our laboratory.

Current silver mining operations of the Polaris Mining Co. in the Silver Belt of the Coeur d'Alene District, and 55 percent owned by Hecla, receive engineering and geological treatment somewhat similar to that described for the Star mine. The nature of the ore bodies, however, has required some changes in methods.

We believe that the methods outlined above have served us well in improving ore extraction and in finding new ore, and that the cost has been amply justified.

Acknowledgments

I wish to express my gratitude to many of my associates for their aid in the preparation of this paper and especially do I appreciate the help of Mr. P. M. Lindstrom, Assistant Chief Engineer and Geologist and the careful preparation of illustrations for this article by Mr. H. E. Harper, Hecla Geologist.

The "leather legged rock hound" has more influence on metal production than ever

Uranium is an important by-product at Bonnie plant of International Mineral & Chemicals Co. in Florida

By-Product Uranium Program*

Economic Production From Low Grade Domestic Phosphate Rock Well Under Way

By JAMES A. BARR, JR.
Assistant Director, Division of Raw Materials
United States Atomic Energy Commission

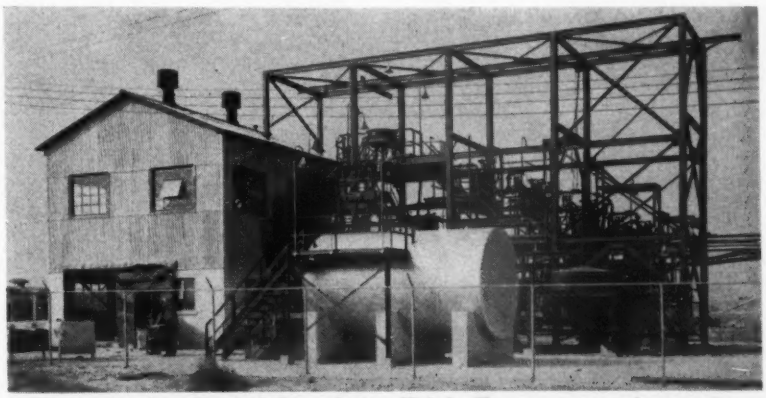
PRINCIPAL sources of uranium are for the present outside of the United States and we are dependent on foreign shipments for a major portion of our supply. The principal foreign sources are Canada, the Belgian Congo and the Union of South Africa. Australia is a promising new potential source and others are being investigated. Currently, our most important domestic production comes from the Colorado Plateau area where there are a number of mills which concentrate and extract uranium from carnotite-roscoelite type, vanadium-uranium ores and other ore types as sufficient reserves are developed.

The Commission is extremely interested in the concentration of uranium which occurs in certain types of marine sediments, particularly the phosphorites and black shale. Although these formations are very low grade and present most formidable concentration and extraction problems, they do offer very large reserves and have been under consideration since 1946 when the Manhattan District began active exploration and research programs on such domestic resources.

The U. S. Geological Survey cooperating with the Commission has maintained comprehensive exploration programs for low-grade sources which offer promise of large uranium reserves, including the extensive phosphate deposits of Western states and Florida.

Highest concentration of uranium in phosphates occurs in deposits of the Pliocene Bone Valley formation in Florida and the Permian Phosphoria formation of Wyoming, Montana, Idaho, Utah in the Western phosphate area. Although uranium concentration amounts to an approximate range of only two-tenths to four-tenths of a pound per ton of prosphate rock, the Atomic Energy Commission has very actively sponsored basic research studies and process development projects in cooperation with the phosphate and fertilizer industry with the objective of producing uranium concentrates as a by-product of phosphatic fertilizers and phosphate chemicals.

The Commission's phosphate program includes all opportunities for economic recovery of uranium concentrates at acceptable prices. Commercial phosphate rock and phosphate pebble have been utilized as a source of by-product uranium since September 1952, in a privately operated recovery plant and shipments of uranium concentrates from this commercial production unit have been continuous since the start of operations. Other recovery units now under construction will make a substantial contribution to the Commission's do-



Virginia-Carolina Chemical Corp. plant at Nichols, Fla., recovers uranium concentrate during fertilizer manufacture

* Based on remarks delivered before Phosphate Fertilizers Industry Advisory Board.

At Joliet, Ill., Blockson Chemical Co. recovers uranium as by-product of sodium phosphate chemical manufacture

mestic uranium program and will be profitable to the operators.

In a new phase of its phosphate program, the Commission contemplates the utilization of a new phosphatic raw material known as "leached zone" or "aluminum phosphate zone" which occurs in the Florida phosphate area as a weathered material, two ft to 25 ft thick, overlying the phosphate rock matrix. During current mining operations this "leached zone" material is cast aside as waste and is considered of little economic value.

In Florida, both raw matrix, which is the source of commercial phosphate rock, and raw aluminum phosphate material contain uranium in minor concentrations of 1/10 lb to 4/10 lb U_3O_8 per ton of material. More than 25,000,000 tons of raw matrix were mined last year from which about 9,000,000 tons of commercial phosphate rock and pebble concentrate were produced. An estimated 14,000,000 tons of "leached zone" material were moved and discarded as waste.

The P_2O_5 content of Florida leached zone material is in the range of 10 to 12 percent. The material can be concentrated by a simple sand-slime separation into a minus 200-mesh slime fraction containing more than 20 percent P_2O_5. New methods being studied increase this concentration to about 30 percent P_2O_5. High grade phosphate rock of commerce has a P_2O_5 content higher than 30 percent. The aluminum and iron content of commercial rock is generally less than five percent, whereas, these elements account for 10 to 20 percent of raw leached zone material.

In the Western part of the United States the large Phosphoria formation of Utah, Idaho, Wyoming and Montana is the source of commercial phosphatic materials. The production of by-product uranium from Western operations is now feasible and substantial production is contemplated as a by-product of the Western phosphate fertilizer industry. The Western phosphate mining and fertilizer industry is expanding very rapidly due to increased demand for phosphatic fertilizer and phosphate chemicals which now require about 1,500,000 annual tons of phosphate rock.

The development of feasible process technology to include all available low grade possibilities will continue to cause furrowed brows for some time to come. However, the objectives are most worthy of consideration and potentialities most attractive for commercial exploitation since, in addition to new phosphatic fertilizers there are co-product and by-product possibilities which include alumina, fluorine, uranium and other minor metal and non-metal values.

Plant of Texas City Chemicals, Inc., has been completed and uranium is being recovered in manufacture of feed-grade and fertilizer-grade dicalcium phosphate

Industrial Uranium Sources

Process studies include the recovery of by-product uranium from industrial sources such as:

A. Wet process phosphoric acid.
B. Phosphate chemicals from wet phosphoric acid.
C. Triple superphosphate fertilizers.
D. Nitric phosphate fertilizers.
E. Normal superphosphate fertilizers.
F. Electric furnace operations for elemental phosphorus.

Process methods resulting from some of these studies have already been accepted by the phosphate industry as indicated by current by-product uranium production. Newer process studies include the operation of two very small pilot plants to prove the process feasibility of producing high analysis fertilizer products from the "aluminum phosphate zone" material. Engineering feasibility studies are now in progress to determine capital and operating costs based on sound engineering principles. Plant food value of these newer products is being determined by a widespread program for agronomic tests under actual farming conditions in addition to the regular greenhouse tests. The processes are quite flexible to utilize a variable raw material and to produce several end products. The significant difference in end products will be in the nitrogen-phosphorus ratio, 11-62-0 to 20-20-0, a range which offers exceptional possibilities for high analysis complete fertilizers and the shipment of concentrated fertilizers to new market areas to the benefit of the phosphate industry and the American farmer.

The Commission's program to develop economic production of domestic uranium from low-grade sources anticipates full cooperation of the phosphate industry. By sponsoring long-range basic research and process development projects, the Commission offers the phosphate industry unequalled opportunity for the conservation of an essential natural resource and realization of new by-product and co-product values through better technology.

This is a most ambitious program which is a challenge to everyone associated with it and success depends largely upon the phosphate industry.

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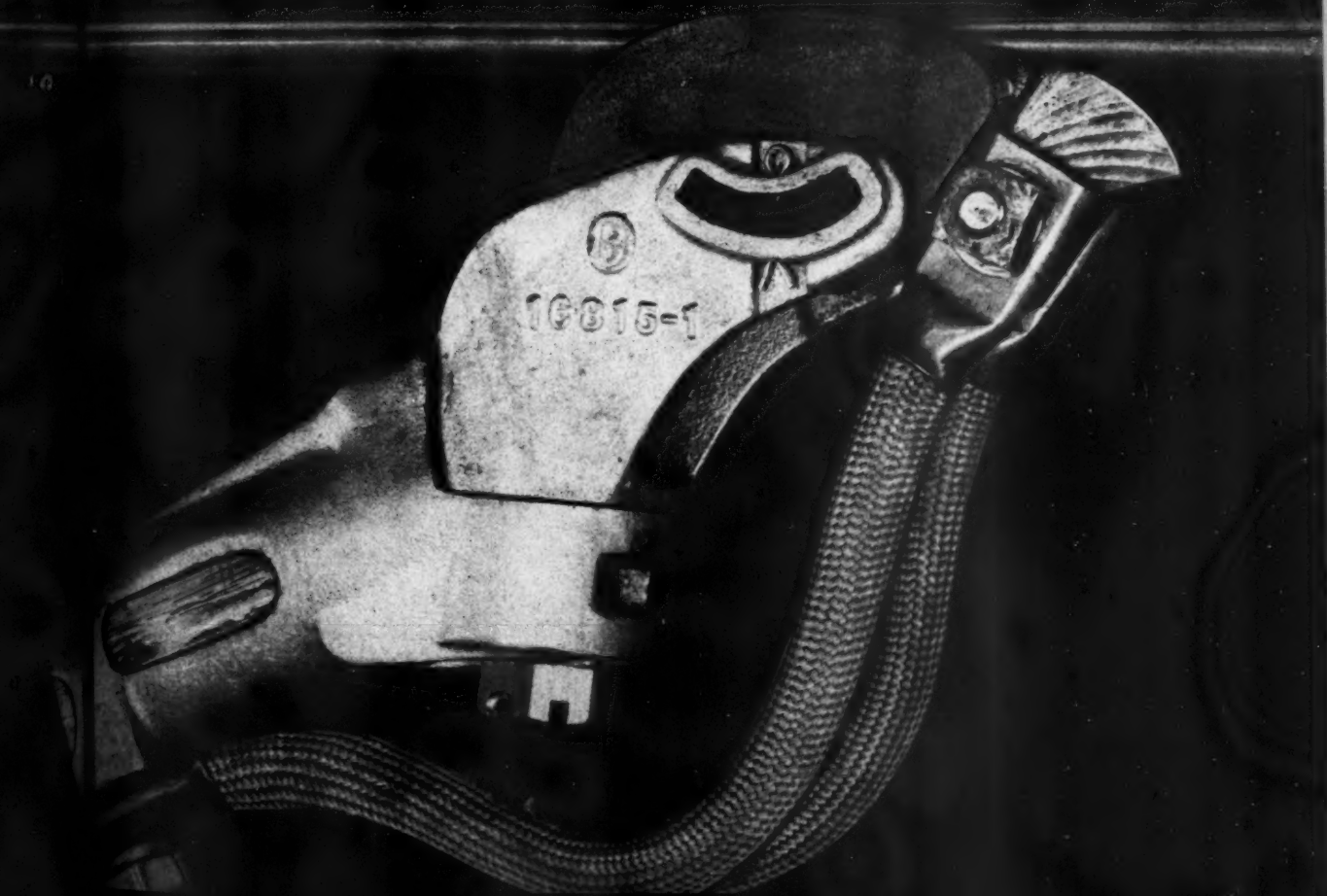

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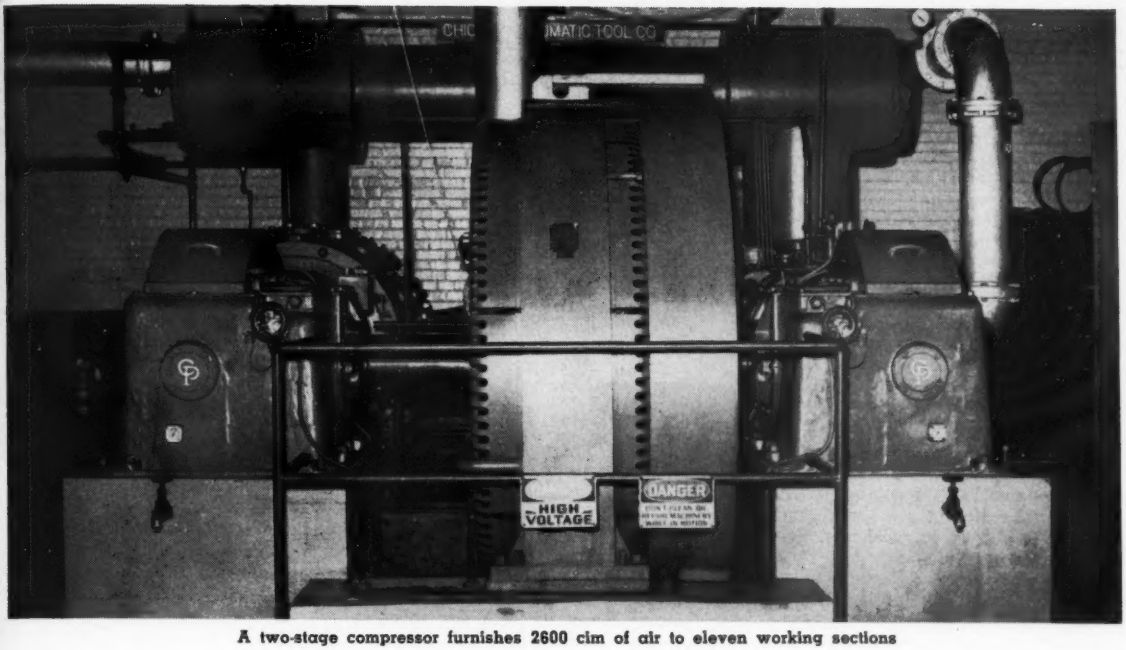


A two-stage compressor furnishes 2600 cim of air to eleven working sections

Pneumatic Drilling For Roof Bolting

A Central Air Compressor on Surface Improves Equipment Performance and Yields Substantial Savings

By MARTIN VALERI and M. M. FITZWATER
Assistant to General Manager and Mining Engineer, Respectively
Buckeye Coal Co.

MUCH has been said and written about roof bolting. The theory of roof bolting, the economic desirability, the benefits derived, the safety and other advantages have all been thoroughly discussed. Roof bolting has perhaps contributed more toward achieving efficient, economical, and competitive mining than any other single factor.

Mining methods, roof conditions, economic conditions, and viewpoints of management vary from mine to mine, and so do roof bolting procedures and equipment. In view of this, it might be well to review some of the problems at the Nemacolin Mine before discussing pneumatic drilling with a central air compressor station. The Nemacolin Mine of the Buckeye Coal Co., a wholly owned subsidiary of The Youngstown Sheet & Tube Co., is located on the Monongahela River in Greene County, Pa., approximately 60 miles south of Pittsburgh. The Pittsburgh seam is mined and the coal is used solely for by-product coking by the parent steel company.

The Pittsburgh seam at Nemacolin has an average thickness of 94 in. Current practice is to mine 84 in. of the coal, leaving 10 in. of top coal. This serves a two-fold purpose; first, it prevents air-slacking of the drawslate; and second, it prevents the contamination of the mined coal with the high ash and sulphur coal concentrated in the top 10 in.

The roof support problem is to secure the various layers of immediate roof. These are 10 in. of top coal; one to two ft of soft, friable drawslate, which expands and crumbles when exposed to air and moisture; an eight-in. seam of wild coal; one ft of shale and drawslate; a six-in. layer of wild coal; and a one to two-ft layer of gray shale. The problem is illustrated in fig. 1. These loosely cemented layers of slates, coals, and shales also contain many slips and faults. The depth of immediate roof varies in faulty areas from zero up to 15 ft before the main rock or sandstone is encountered.

Before the era of roof bolting, systematic timbering was used. This called for 13-ft 6-in. H-beams on five-ft centers on the main haulages. These were supported by treated posts and the space between beams was lagged with three-in. planking and cribbed to the roof. In short life sections, 14, 16, and 18-ft round timbers were set on a maximum of five-ft centers, and closer where required.

Even with the utmost precaution, approximately 40 percent of the intersections caved soon after being driven. Frequently, falls were cleaned up and retimbered, only to fall again as more top gave way above the timbering. Now, after the installation of approximately 380,000 roof bolts, it is estimated that less than one percent of the roof bolted intersections collapse, and then only after considerable time and with adequate and sufficient forewarning. These occasional falls occur in faulted areas even when the bolts are augmented with beams or timbers.

Began Bolting in 1950

Roof bolting began at the Nemacolin Mine in November, 1950, after extensive investigations by mine management as to the best method to be used in drilling the holes. It was

found that there was no rotary tool on the market at that time which could speedily and satisfactorily drill the coarse, gray sandstone that was to be the anchorage rock. This eliminated rotary equipment and turned the eyes of management toward pneumatic percussion drills.

Equipment was purchased and a roof-bolting program begun in a faulted section of the mine. Air stopers had a consumption of approximately 110 cfm at 100 psi. They were 47 in. long plus a leg extension of 40 in. Impact wrenches having a maximum torque of 600 ft lb and consuming about five cfm were selected to tighten the bolts. Dust collectors were obtained having an air consumption of approximately 15 cfm at 100 psi. Due to varying heights of the coal, the size of drill steel had to be calculated to give the widest range of use. It was decided to standardize on ⅞-in. hexagonal drill steel in lengths 28, 46, 70, and 80 in. Collared drill steels were used at first, but these soon gave way to collarless steels when a tendency to shear at the collar was noted. Detachable single-use bits were used—a 1⅜-in. bit for the first part of the hole and a 1¼-in. bit to finish. Air for drilling was supplied by a 240-cfm rubber-tired compressor, connected to the drilling equipment by 50 ft of 1¼-in. rubber hose.

After a thorough examination of the roof strata by the U. S. Bureau of Mines, it was recommended that roof bolts of five and six-ft lengths be used. Initial work with roof bolts was confined to bolting intersections outby the working faces. Bolts were installed on four-ft centers.

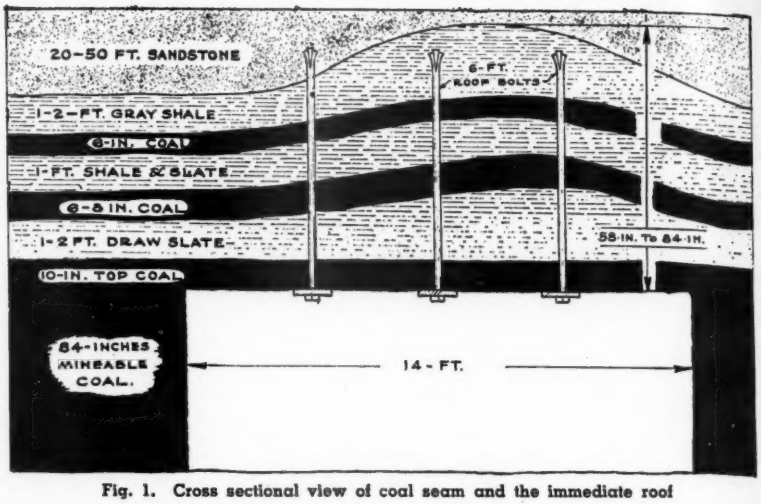


Fig. 1. Cross sectional view of coal seam and the immediate roof

Early methods required that four-in. channels be used with the bolts. The roof channels were used to give maximum support during the early days of bolting and to help build up confidence in roof bolting. This practice has been discontinued except in extremely faulty areas. Originally the size of the bearing plate was 8 in. by 8 in. by ⅜ in. This was later reduced to 6 in. by 6 in. by ⅜ in. to eliminate the cupping action of the larger size plate.

Although many coal mines are leaning more and more toward the use of expansion shells with ¾ or ⅝-in. bolts, Nemacolin management has standardized on one-in. round, wedge-type bolts. The one-in. slotted wedge type bolts used at Nemacolin are manufactured by the parent company. The Youngstown Sheet & Tube Co.

Torque wrenches were placed in each section as standard equipment to be used by the face boss to spot check the degree of tightness of the bolts. A torque of 225 to 250 ft lb per bolt is maintained. Periodically a representative number of roof bolts are tested to determine their holding value. The test consists of subjecting a bolt to load until it slips. These pull loads vary from 15 to 20 tons.

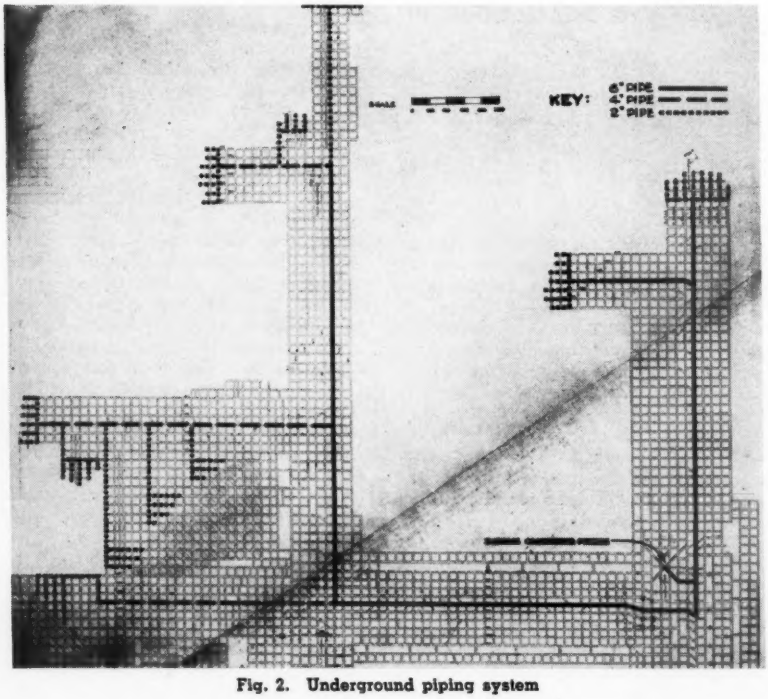


Fig. 2. Underground piping system

Try Portable Compressor

Using one stoper and a two-man crew, the compressor was moved to the face region to fit roof bolting into the face cycle. Before long it was found that one stoper could not keep up. With steel changes and a drilling speed of two fpm at a pressure between 90 and 100 psi, it took the one stoper approximately 35 min. to bolt an 8½-ft by 14-ft cut.

In order to speed up the roof bolting phase, two stopers and two dust collectors were operated from the one compressor. This meant that air consumption would be nearly 250 cfm, or the capacity of the compressor itself. The compressor was unequal to the task. It had to labor constantly to supply the needed air and then could only keep the pressure at the stopers between 60 to 70 psi. Time studies showed that at this reduced pressure it took twice as long for a stoper to drill one hole. Consequently, it took the same amount of time for two stopers to drill eight holes as it did for one stoper. There just wasn't enough receiver space to carry the added demand for air.

Because of excessive vibration of the compressor, much electrical trouble began to crop up, especially contactor trouble in the control box. Heating of the resistors was another problem which entered the picture and helped destroy electrical circuits. This heat also caused the 1¼-in. rubber hose to deteriorate, and made the working place warm.

To counteract these disadvantages, it was decided to experiment a little further. The compressor was moved back from the face and placed in a crosscut with another 240-cfm compressor. These two compressors fed into a receiver having a capacity of 144 cu ft. From the tank a four-in. pipe line was laid to within 400 ft of the working face, and a two-in. line carried the air the remainder of the distance to the face. A home-made, three-wheeled cart was used to carry the two-stoper outfit from place to place. This equipment was connected to the two-in. air line by 100 ft of 1¼-in. rubber air hose.

It was found that with the added receiver capacity, two stopers could be operated simultaneously at good pressure with no slowing down of the drilling speed. A second section was put on bolting and connected to the original four-in. line by 500 ft of pipe. Two stopers were operated in this butt section and the pressure remained in the 80 to 90 psi range, a good drilling pressure.

Mechanical Trouble

As time went on it was found that mechanical trouble plagued the operation. The two compressors had to operate under full load ⅔ of the time. Overheating persisted and contactors continued to be troublesome. Any break-down meant a considerable amount of down-time for the roof bolting crew before the pressure could be restored. Another evil was the collection of water in the tank and air lines. These had to be drained at frequent intervals, and even then water would work its way up through the line to the face. It became evident that some better method of furnishing air to the bolting crews had to be evolved before roof bolting could be depended on as the sole means of roof support at Nemacolin.

There are three common methods of supplying air to drills underground: first, mobile compressors trammed to the face; second, central underground stations furnishing air to two or more sections; and third, central above-ground stations piping air to the roof bolting sections inside the mine.

Since the new Nemacolin West Mains shaft and portal is centrally located for all future development, it fitted nicely into a central compressor setup. Mine projections were laid out to include 14 active sections in the western end of the property serviced by the new West Mains shaft and portal. A central compressor located on the surface at the new shaft could supply 240 to 250 cfm at 100 psi for each of the 14 sections. This would require a much smaller investment than 14 underground portable compressors. Small stationary compressors according to manufacturers' quotations would cost approximately half as much as mobile units. It was also learned that the cost of a large compressor capable of supplying air for these sections was less than half that of the equivalent in small stationary compressors. In addition to this cost analysis was the important fact that the parent company made known that they could always find use for a large compressor if one was purchased for the mine and later it was found desirable to dispose of it.

Select Surface Compressor

Mine management, with the advice of compressor manufacturers, decided to purchase a 2600-cfm compressor in view of the air requirements and load factor. The order was placed for a two-stage compressor. Auxiliary equipment consisted of:

(1) A 500-hp synchronous motor, 225 rpm, 3 phase, 60 cycle, 2300 v, ac
(2) A motor-generator set; 1800 rpm, 125 v. dc generator; 440-volt, ac motor, field rheostat and line starter
(3) Starting panel
(4) Pipe line after—cooler with automatic drain tap
(5) A 54- in. by 14-ft. A.S.M.E. Code, vertical air receiver with fittings for 120 psi maximum working pressure
(6) Intake air filter
(7) Mercoil temperature shutdown controls on main bearing and crosshead guides which are actuated at 140° F

A building was erected to house the air compressor and auxiliary equipment. It was 28 ft wide by 36 ft long by 13 ft high—more than ample to allow room for making repairs, cleaning tube nests, and general rou-

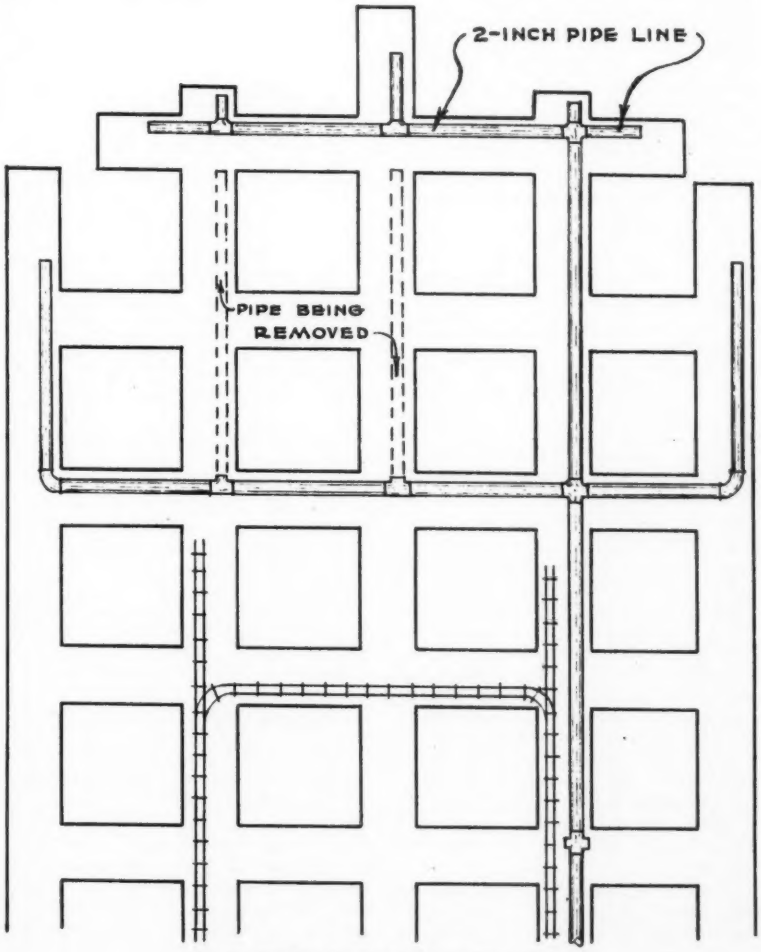
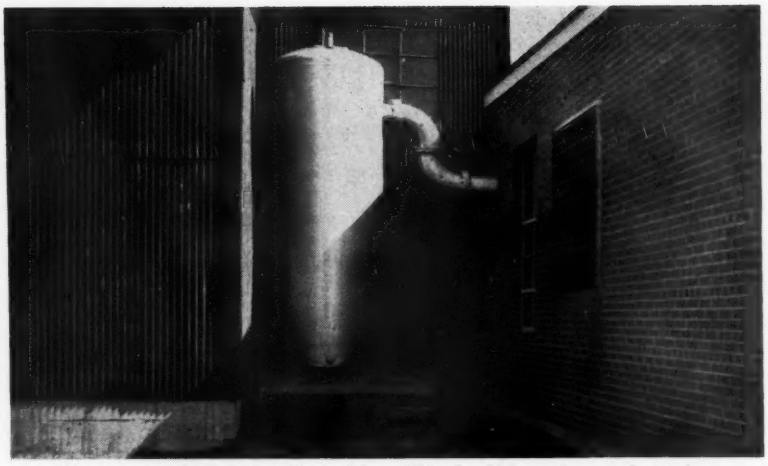


Fig. 3. Pipeline layout in the working section



Compressor pulsations are damped in a 57-in. by 14-ft receiver at the surface

tine inspections. The building is of brick wall construction. It has a concrete reinforced floor and concrete compressor foundations.

A 14-in. air intake line extends through the roof to the outside air. An air intake filter is attached to prevent particles of dirt being drawn into the system and the top is protected with a hood to prevent rain from entering.

Automatic Controls

The compressor is provided with a five-step automatic capacity regulator. With this regulation the compressor operates at full, ¾, ½, ¼, or no load depending upon the amount of air being used. This multistep control, meets partial load demands with maximum economy, automatically adjusting the output of the machine and power required, and enabling the motor to operate at its highest points of efficiency. The compressor is equipped with a shell and tube type intercooler to assure effective air cooling between the two stages, resulting in conservation of power, moisture removal and improved compressor performance.

Oil and water in compressed air cause considerable annoyance and expense. In pneumatic tools water washes away the lubricant causing rapid wear and excessive air consumption. Frequently water freezes at the exhaust of tools, retarding their operations. To remove water and oil vapor before compressed air enters the pipe lines, it is necessary to condense it by cooling. To do this, an aftercooler was placed between the compressor and the receiver tank. It is of the pipe line type, the cooler serving as a section of the air discharge.

Because of the remoteness of the mine shaft, no constant supply of clean cooling water was available. To overcome this problem, a cooling water tower and pump was obtained to cool and circulate in a closed system, water used by the intercooler and aftercooler. The water system was set up so that any stoppage in the flow of water would result in an increase in water temperature and trip a mercoil temperature control set at 140° F. This control stops the compressor and prevents damage from excessive heat.

On the exterior of the compressor building the discharge line is connected to a 54-in. diam. by 14 ft vertical air receiver. This receiver tank serves to dampen the pulsations, to deliver air at a steady pressure, and to further aid in precipitating oil and moisture from the air.

The underground piping system is shown in fig. 2. Compressed air enters the mine through the 500-ft air shaft and is piped through a six-in. air line along the main headings to four-in. air lines in the butt headings. Two-in. lines carry air from the four-in. line, to a point near the coal loading face. From here, 100 ft of 1¼-in. rubber air hose leads to a manifold built on the roof bolting cart. The amount of two-in. line is held under 2000 ft to eliminate low pressure at the stopers. Friction losses in the two-in. pipe at a flow of 250 cfm and 100 psi are 4.78 lb per 1000 ft of pipe. To date a total of 15,000 ft of six-in. line has been installed, and 7500 ft of four-in. line to supply air to 11 sections.

Problems to Be Solved

In the authors' estimation there are several problems in pneumatic drilling which remain to be solved. These include:

(1) ***Drill Steel Breakage***—Considerable breakage is being experienced with ⅞-in. hexagonal carbon steels. Mine management is experimenting with ⅞-in. quarter octagon drill steels in an effort to overcome this costly weakness. Some operations have turned to alloy steel and report good results.

(2) ***Excessive Bit Wear***—The footage obtained per 1-¼-in. bit is no more than 10 to 15 ft. Tungsten carbide tipped bits have been tried but the footage obtained has not justified their cost.

(3) ***Excessive Maintenance of Pneumatic Tools***

There is one big disadvantage to using a single outside compressor station. In case of a mechanical failure to the compressor, all units depending on it would be without air. This is a remote possibility and to date no failure has been reported by any operation. Another disadvantage is the amount of pipe required to furnish air to the various sections.

After the compressor had been in operation for three months, it began to heat up and lose efficiency. It was found that a deposit was building up in the cylinders at each end of the piston stroke. The grade of lubricating oil was changed and the trouble eliminated. The only other trouble encountered has been the inspection and maintenance required for the valves. The diaphragms in the unloading valves bake because of the heat and must be replaced periodically. To date, these are the only troubles that have been encountered with the compressor.

Many Benefits

In conclusion, mine management points out the following advantages for the outside compressor station:

(1) A constant supply of air at a constant pressure at the stopers.

(2) Constant air supply has eliminated over-time for the bolting crews and has enabled them to install as many bolts as required by the loading unit, plus additional ones if needed.

(3) Maintenance and upkeep of the compressor has been negligible.

(4) AC power gives uniform voltage at the compressor motor, and the 500-hp synchronous motor helps the power factor.

(5) Reduced over-all power costs with the elimination of the numerous portable or stationary compressors with their 50-hp dc motors.

(6) Eliminated another piece of mobile equipment and trailing cable at the face in the case of the rubber tired compressors.

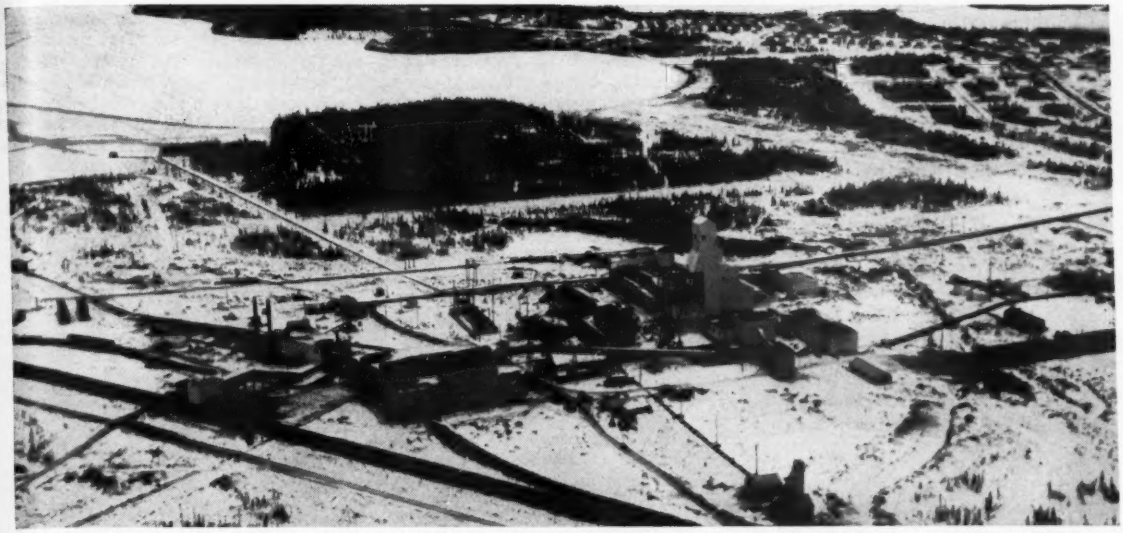
(7) Intake air is clean. This is not the case with underground air.

(8) Eliminated water trouble in the air lines and drilling equipment.

(9) The pipe line from the compressor to the section adds receiver capacity.

(10) Automatic controls reduce the amount of attention needed. With the underground compressors, more maintenance work was placed on the mechanical force.

(11) Substantial savings in capital investment.



An ammonia leach process has been developed to treat nickel-copper-cobalt ore at the Lynn Lake mine of Sherritt Gordon Mines, Ltd.

Alkaline Pressure Leaching Processes*

Operation at High Pressures and Temperatures Speeds Reactions, Permits Difficult Separations With Great Economies in Equipment and Reagents

By F. A. FORWARD

Head, Department of Mining and Metallurgy
University of British Columbia

LEACHING processes employing acid, alkali, or salt solutions such as the cyanide process, copper leaching, and zinc leaching, have operated successfully for many years. That they have done so may be attributed in part to individual circumstances such as availability of low cost reagents in certain areas but is probably due largely to the technical and economic advantages offered by process of this kind.

In general it may be said that such processes are most likely to prove economically useful when a leaching agent is available that will dissolve the desired metals rapidly, efficiently and selectively to provide a solution from which the metals can be easily recovered and which can either be regenerated and used cyclically or treated to produce a useful by-product.

Although it has been the general practice in the past to operate leaching processes in open vessels at atmospheric pressure it is evident, from a consideration of a number of factors, that operation at superatmospheric pressures and elevated temperatures may well provide a number of important advantages such as:

(A) The rate of reaction is increased several fold by operating at temperatures above the boiling point of a leach solution.

(B) Many chemical reactions will proceed rapidly at high temperatures and pressures that will not take place at temperatures below boiling or at low gas pressures.

(C) Where volatile reagents such as ammonia are used the vapor pressure is so high at temperatures well below the boiling point that the handling and retention of reagents can be effectively carried out only in closed vessels under pressure.

(D) In operations which involve the reaction of a dissolved gas such as oxygen or hydrogen the maintenance of an adequate concentration of the gas in the leach solution is possible only under elevated pressures, especially when the leaching temperatures approach the boiling point.

With the exception of the Bayer process for alumina and one or two others relatively little attention has been paid to the use of pressure operations in the non-ferrous metallurgical field. At the same time the difficulties associated with pressure operations in the laboratory have deterred research investigators in this field. Hence, very little thermodynamic or other data are available and relatively little is known of the reactions involving gases, salts, and water at high temperatures. What has been done indicates that relative reaction rates and equilibria change markedly, unusual separations can be effected, the activity of components altered, and important catalytic effects achieved. On the basis of chemical results, therefore, operation at high temperature and high pressure has many attractive potentialities.

While it is true that the design and operation of pressure leaching plants require close attention to engineering details and the employment of competent operators the development of industrial techniques in recent years has been such that comparatively little difficulty is encountered in meeting these demands.

Vessels can easily be constructed to operate at pressures up to 1000 psig. The increased reaction rates at higher temperatures are such that the ves-

* Presented by permission: Sherritt Gordon Mines Limited and Atomic Energy Control Board of Canada.

sels are but a small fraction of the size of units required to carry out operations at room temperature. Devices are available for feeding and discharging pulps continuously under pressure, and for agitating the slurry. Corrosion and erosion, specially in alkaline solutions, are relatively unimportant factors which can be easily taken care of by using stainless steel or other suitable materials of construction. Experience has shown that operators readily learn to handle high pressure units safely and efficiently. Thus it appears that no engineering or operating difficulties are encountered in alkaline pressure leaching which can not be overcome by proper design and competent management.

The principles and practice of alkaline pressure leaching and metal precipitation processes may best be illustrated by outlining the features of two such processes. One is an ammonia leach process for recovering copper, nickel, and cobalt from sulphide concentrate; the other is a process developed in the laboratory for recovering uranium from a variety of ores and which is particularly advantageous in treating ores containing a high percentage of calcium carbonate.

AMMONIA LEACH PROCESS

During the past seven years Sherritt Gordon Mines Limited, faced with the knowledge that their copper-zinc-gold mine at Sherridon, Manitoba would be exhausted by 1951 have been developing a nickel-copper mine at Lynn Lake, about 150 miles north of Sherridon. The result of this work has been the establishment of a proven reserve of over 14,000,000 tons of ore containing 1.223 percent nickel, 0.618 percent copper, and additional cobalt values.

As the new mine is located nearly 150 miles from the previous railhead at Sherridon the development of the property to the production stage has not only presented some unusual economic problems but has also provided an opportunity to develop new metallurgical treatment methods. Within the last three years a railroad has been built, a townsite developed, the original Sherridon mill and mine equipment transferred to Lynn Lake by sleigh and the mine plant prepared to produce 2000 tpd of ore. Operation of the mine and mill was due to commence in the 4th quarter of 1953.

Work Out Method

Paralleling the exploration and development of the mine has been a metallurgical research and development program designed to work out an economic treatment process to produce nickel, copper, and cobalt from the ore at the lowest possible cost. This work initiated in the laboratory in 1947 resulted in the development of an ammonia leach process which was tested exhaustively in a series of pilot plants during the past four years to provide operating and design data for the commercial plant now under construction at Fort Saskatchewan, Alberta, planned to commence operation early in 1954, and designed to treat 240 tpd of nickel concentrate to produce high purity nickel, cobalt, copper, and ammonium sulphate.

The nickel concentrate has the following approximate composition:

Nickel	10 -16	percent
Copper	1 - 2	
Cobalt	0.2- 0.4	
Iron	35 -40	
Sulphur	28 -34	
Insol	8 -14	

Precious metals less than .02 oz/ton.

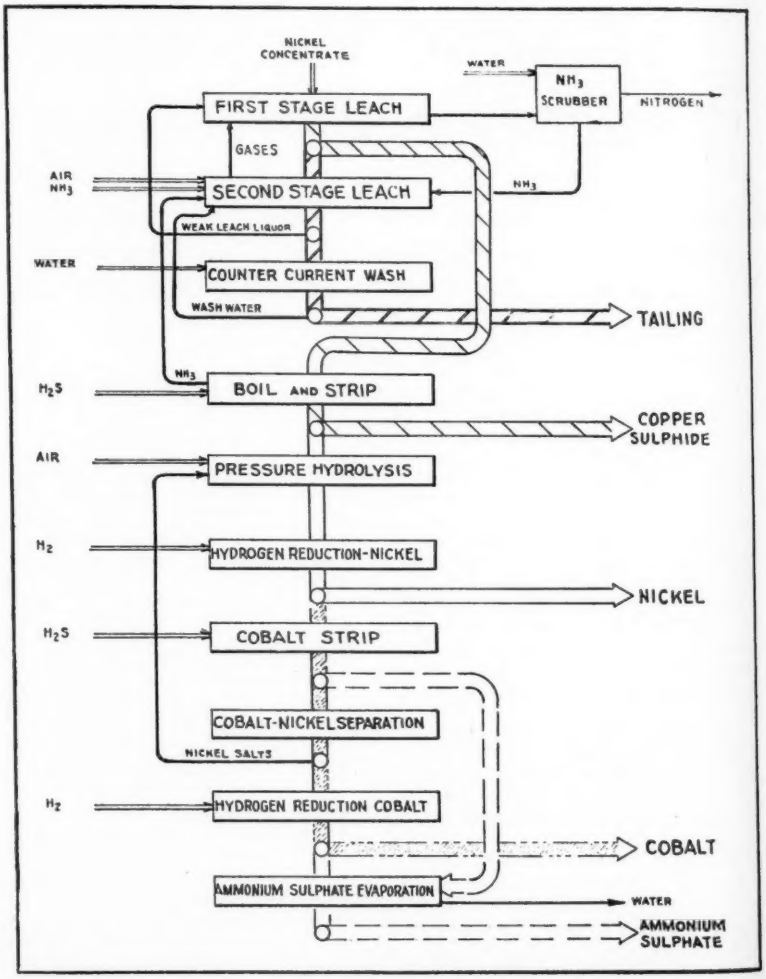
During the initial stages of operation the copper in the ore will be recovered in a separate copper concentrate and shipped to a smelter for treatment by conventional methods.

The leaching and metal recovery process comprises a series of chemical reactions which in themselves are relatively simple and effective and which have been found easy to operate and control in the pilot plant.

Leach in Autoclaves

In the process the sulphide concentrate mixed with water is leached in continuous autoclaves in a countercurrent system at pressures below 125 psi with a pulp temperature between 150°F and 200°F. Measured amounts of ammonia and compressed air are charged to the system to react with the concentrate.

The effluent gases are washed to recover ammonia, the tailings are thickened and washed in the usual manner and wash water is returned to the system. The pregnant solution containing nickel, copper, and cobalt



Schematic outline of process, showing reagents used, main production and re-cycle streams, and products of the "A" mine plant at Sherritt Gordon Mines, Ltd.

ammines is free of iron but contains a number of ammonium salts including thio-sulphate, thionate, sulphate, and sulphamate.

This solution is boiled in a continuous unit to drive off free ammonia and to precipitate copper as sulphide by decomposition of the thionate present. The copper is recovered as a sulphide containing about 70 percent copper, which will be treated subsequently to produce copper metals or salts. The copper-free solution is then heated and oxidized and clarified in a continuous pressure unit to convert thiosulphate and sulphamate to sulphate and to produce a purified solution for nickel precipitation.

Precipitate Nickel

This solution, stored under pressure after clarification is charged with hydrogen to an agitated autoclave operating in the range 300°-500°F at total pressures between 500 psig and 900 psig which includes the overpressure of hydrogen as well as that of the water-vapour. The hydrogen reacts very rapidly with the nickel ammine present to precipitate metallic nickel. Usually, for example, the nickel is reduced from 50 gm per liter to one gm per liter in about 20 min reaction time.

The product is a fine powder in which every particle of nickel is approximately 40 microns in diameter. There are no fine particles and no lumps. The reduced nickel and the end solution are discharged to a flask tank, the nickel separated and washed, and finally dried in a steam drier to give a final product having the following analysis:

Nickel + Cobalt	99.95 + percent
Cobalt	0.06
Iron	less than 0.01
Copper	less than 0.01
Sulphur	less than 0.01

Recover Cobalt Too

The nickel reduction operation is conducted in such a way that the cobalt present in the clarified solution is not reduced but remains in the end solution with about 2 percent of the nickel. This solution is stripped with H_2S and the nickel-cobalt sulphide precipitate treated to separate nickel and cobalt. The nickel is returned to the nickel precipitation unit and the cobalt is finally precipitated under pressure with hydrogen to produce metal having the following analysis:

Cobalt	99.6 + percent
Nickel	0.15
Iron	0.20
Sulphur	0.02
Copper	nil.

The solution remaining after stripping and hydrogen precipitation contains the sulphur dissolved during leaching, now present in the form of ammonium sulphate. These solutions are evaporated to produce fertilizer grade ammonium sulphate, which constitutes an important by-product of the operation.

Recoveries in the pilot plant are as follows:

Nickel	92–95 percent
Copper	88–92
Cobalt	50–65
Sulphur	60–70

Initially production in the commercial plant is expected to be:

Nickel	16–17,000,000 lbs. per year
Copper	1½– 2,000,000 lbs. per year
Cobalt	3– 4,000,000 lbs. per year
Ammonium sulphate	.60–70,000 tons per year

In addition, copper will be produced as copper concentrate and some excess ammonia will be available for sale at the ammonia plant which is being constructed in association with the leaching plant to produce ammonia from natural gas.

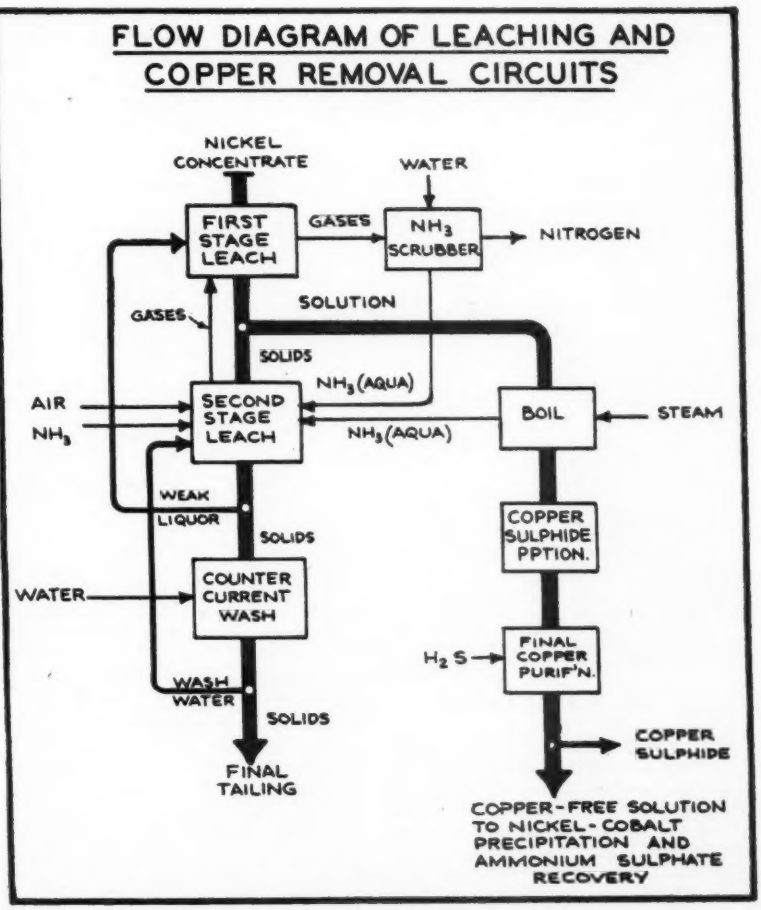
In the pilot plant little difficulty has been encountered with corrosion, erosion, scaling, or precipitation of insoluble salts at any stage in the process. To reduce maintenance all wetted surfaces of autoclaves, agitators, pipelines, pumps, valves, tanks, and filters are constructed of stainless steel.

Solution flows, pulp volumes, gas streams, ammonia, air, steam additions, autoclave temperatures, cooling water and other components of the entire operation are measured and regulated by automatic control instruments, thus reducing to a minimum the amount of attention required.

The pressure leaching circuit has operated for many months uniformly and smoothly, always under the control of the operators. The continuous feeding and discharging devices and other regulators have performed satisfactorily. The nickel precipitation operation has been shown to be such that it can be carried out readily in the pilot plant to produce metal and end solutions of uniform predetermined composition.

Recover Cost in Year

The cost of the development program has been approximately $2,500,000 but the estimated cost advantage



Copper is removed first from the Lynn Lake ore

by comparison with conventional smelting and electrolytic processes is such that the total cost of process development should be regained in a little more than one year of operation.

URANIUM ORE TREATMENT

The recovery of uranium from ore presents problems similar in some respects to those encountered in treating base metal ores but which parallel even more closely many features of gold metallurgy.

For example, the uranium content of the majority of the ores treated is very low—usually a fraction of one percent; concentration by gravity or flotation is ordinarily ineffective as metal losses are high and the ratio of concentration too small to be economically useful; uranium has a relatively high value and a ready market; occasionally the uranium is accompanied by other metals (such as vanadium) from which it must be separated. In these respects gold and uranium are very much alike, but they differ in that gold can be recovered by smelting while pyrometallurgical processes are not generally applicable to uranium ores.

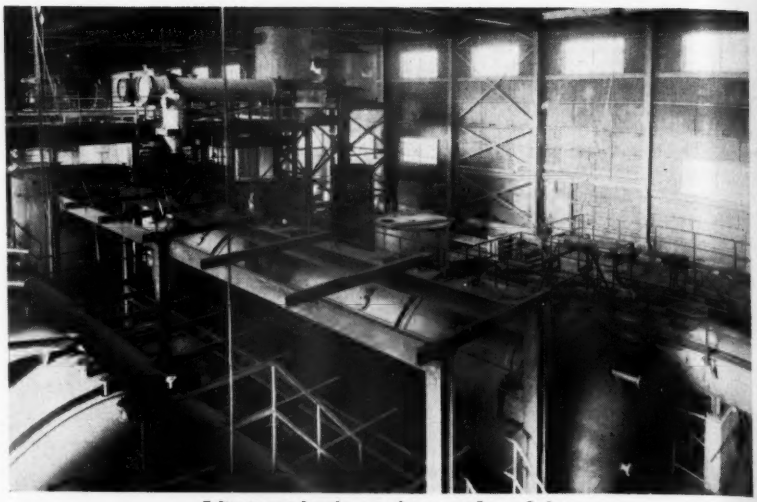
Leach Only Feasible Method

Thus for uranium a leaching process comparable to cyanidation is the only procedure that appears to be feasible and profitable. Fortunately uranium is soluble in both acid and alkaline solutions and can be recovered from these solutions by chemical methods. Just as for other metals the choice of a leaching process is usually determined by the character of the ore to be treated, the availability and cost of reagents, the cost of plant and the simplicity of operation.

An alkaline pressure leaching process for the treatment of a variety of uranium ores which was worked out in the metallurgical laboratories of the University of British Columbia some two or three years ago has a number of favorable features which are not found in acid leaching processes or in basic leaches operating at atmospheric pressure. An outline of the problems involved and a brief description of the process will serve to illustrate the usefulness of the pressure leach.

Choose Alkali Leach

Uranium when fully ozidized is soluable in sodium carbonate solution forming a uranyl carbonate complex. However in the ores examined in the laboratory the uranium was present in pitchblende, a form in which it is only partially oxidized and which requires further oxidation by a chemical oxidizing agent or oxygen before the uranium can be extracted. Further, the gangue consisted of silica and limestone, the latter in some cases comprising 50 percent of the ore, which ruled out the possibility of using an acid solvent.



Adjustment leach autoclaves at Lynn Lake

Assuming that the uranium could be oxidized and dissolved in a sodium carbonate leach solution and separated from the gangue there remained the problem of precipitating the uranium from the leach solution. As it is known that reduced uranium compounds are insoluble in sodium carbonate solutions it would be logical to expect that if the soluble uranium complex could be reduced it would precipitate. Earlier experience with hydrogen reduction in the presence of a suitable catalyst suggested that such a procedure would be effective.

Operating Procedure

Finely ground ore was mixed to 50 percent solids with a solution containing 5–8 percent sodium carbonate and 2–3 percent bicarbonate, placed in an autoclave and heated to 200–250°F with agitation in the presence of oxygen at 20 psig (equivalent to 100 lb. air pressure). During the leach sulphides such as pyrite were partially oxidized to produce sodium bicarbonate and sodium sulphate, while the pitchblende was oxidized and the uranium dissolved as the carbonate complex. Part of the vanadium, when present, was also dissolved to form a vanadium carbonate complex.

The leaching was complete in 3 to 12 hr, the rate being governed by temperature, agitation, oxygen pressure, and degree of comminution of the ore. At the end of the leaching period, the pulp was filtered, the cake washed with barren solution and discarded and the clarified pregnant solution containing uranium, sodium carbonate, sodium bicarbonate, sodium sulphate, and vanadium if any were present in the ore was sent out to the precipitation process.

Nickel Is Catalyst

Precipitation was effected by adding about 10 gpl nickel powder to the pregnant solution, heating the mixture in an autoclave to 250–300°F in the presence of hydrogen at an overpressure of 200–300 psig. The nickel acted as a catalyst and the hydrogen reduced the uranium to a lower valency form, UO_2, which was insoluble in the carbonate solution. At the same time an equivalent amount of bicarbonate was formed.

The UO_2 and nickel were separated from the barren solution by filtration and the solution recycled to treat a subsequent ore charge. The nickel was separated from the UO_2 by a magnetic separator, the nickel being recycled to a subsequent precipitation operation and the UO_2 dried to give a final product containing over 90 percent U_3O_8.

Where vanadium was present in the ores and was dissolved during leaching, the uranium and vanadium were precipitated together by the hydrogen-nickel procedure and separated by fusing the UO_2–V_2O_3 precipitate with soda ash, the vanadium being thus rendered soluble permitting separation from insoluble UO_2.

By the hydrogen precipitation procedure the uranium can be completely stripped from the leach solution—down to less than 0.01 gpl—the hydrogen consumed is equivalent only to the uranium precipitated; the time required for precipitation is proportional to the amount of uranium present and to the amount of nickel used; also the time is dependent to a considerable degree on the temperature and hydrogen pressure—it may be

(Continued on page 77)

In actual operation Canton products are self-liquidating in a short time

Canton Quick-on Cable Splicer

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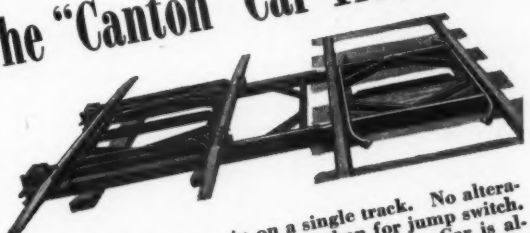

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Proper maintenance means smooth riding, dust-free roads

How Can You Prevent Dust On Haulage Roads?

Experience of the Country's Highway Departments Shows Importance of Construction and Maintenance Details

THE dangers and nuisances created by dust on haulage roads in open pit and strip mines are well understood by the industry. Poor visability, wear and tear on equipment, driver fatigue, poor public relations—all these, and more, are caused by dust.

Dust can be allayed in several ways. Probably the most common way is to sprinkle the road whenever it begins to dry out. This is satisfactory but can be costly. Hard surfacing is also out of the question in most cases. This article will deal with the use of calcium chloride and how, through an effective road maintenance program, dust on haulage roads can be kept to a minimum.

Dust Is Part of Road

Whenever you see dust flying off a haulage road you see part of the road blowing away. True enough this is fine material, but it is needed as a binder for the coarser aggregate and its loss is detrimental to the road. As the binder is lost it leaves the larger material in an unconsolidated or floating state and it in turn is lost, raveling off to the side.

Moisture is important to the road. It surrounds each particle with a thin film, making those that would normally blow away heavy enough to stay in place. Because of its hygroscopic properties calcium chloride can provide this needed moisture. Hygroscopicity is the process of readily absorbing and retaining moisture. Calcium chloride, then, attracts moisture out of the air and, because it also reduces the vapor pressure, it retards evaporation. For similar humidity and temperature the vapor pressure of a calcium chloride solution is always lower than that of water.

Speaking practically, the effect of calcium chloride is to absorb moisture during periods of high relative humidity, such as at night, and to retard evaporation of that moisture during the heat of the day. The effect is similar to a light rainfall each night as contrasted to untreated roads which do not recover moisture and often completely dry out between rains. This is shown graphically in fig. 1 prepared from data collected in laboratory experiments.

The fastest way to allay dust with calcium chloride is to just spread it over the road surface. This should be done after a rain or after the road has been sprinkled. However, experience has shown that an application in the late evening is also effective as it allows the calcium chloride to at-

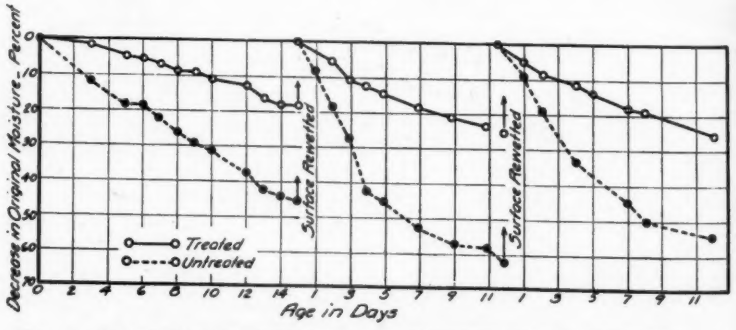


Fig. 1. Relationship between initial and subsequent rates of evaporation of moisture from treated and untreated soils

Many times, binder can be pulled in from the road shoulders

tract water from the air during the period of higher relative humidity. That is not to say that a treatment on a dry road during the day is not helpful but, the more moisture present at the time of application the more effective will be the application.

An initial treatment with calcium chloride should be made at the rate of one lb per sq yd of road surface. Additional applications of ½ lb per sq yd are to be made as soon as the road begins to dust.

Add Needed Sizes

A more permanent and satisfactory job of dust treatment is given the title of "surface consolidation" by highway engineers. This differs from the method just described in that the road surface is consolidated by the addition of fine or coarse material as needed to obtain a dense, compact riding surface. It has the added benefit of reducing road maintenance and improving the road.

To fully appreciate the whys and wherefores of surface consolidation, let us study a perfect road surface. The word surface as it is used here refers to the last layer of gravel or aggregate put down, generally the top three or four in. of any dirt road. This layer should possess several physical properties which are of great importance. The kind of material is not as important as is its size consist. Nearly all aggregate will perform satisfactorily, and there are many miles of road giving good service today made from such local material as gravel, limestone, chert, Red Dog, slag, cinders, sandstone and sand clay.

The big secret of a perfect road surface is its density. There should be no voids, which means that the size consist of the aggregate should be controlled down to a size of 200 mesh. A top size of no more than one in. should be used. An average gradation would be as follows:

Size Screen	Percent Passing
1 in.	100
¾ in.	85-100
⅜ in.	65-100
4 mesh	55-85
10 mesh	40-70
40 mesh	25-45
100 mesh	10-25

In addition, the fraction passing through the 200-mesh screen should be no greater than ⅔ of the fraction passing through the 40-mesh screen.

As mentioned before, this is a hypothetical road surface. If the above qualifications can be met by local material, you have the makings of a fine road. However, don't despair if local material won't fit. Experience has shown that certain materials which fall outside the specifications are suitable under many conditions.

Moisture Content Important

The material should have a moisture content of from between seven and eight percent by dry weight. This last point is important as more or less moisture will make it impossible to attain maximum density during compaction. Ultimate failure of many roads has been traced to an inability to attain or maintain the proper moisture content in mixtures during the compaction period. Here again, because of its hygroscopic properties, calcium chloride can be used to great advantage.

Unless limestone fines are used in the road surface, loam or clay having some "sticky" qualities should be used to serve as a binder. Sand or silt is not considered suitable for binder. In the road surface, the larger sizes carry the load and the smaller sizes hold or

Loose float on the road surface signifies the need of fines to make a smooth, compacted surface. Shown here is a typical before and after sequence

bind the road surface together. Because all the voids are filled, moisture is maintained longer and there is no internal grinding action.

Testing Method

A rough method of testing road binder without laboratory equipment has been described by Hogentogler and Willis in *Public Roads* as follows:

"If a sample of well-graded material is wetted and squeezed in the hand, the following characteristics will be noted: (a) the soil is extremely gritty; (b) it can be formed into definite shapes that retain their forms even when dried; (c) if the clay alone adheres to the hands, it will only be enough to discolor them slightly; (d) if more than enough soil to discolor the hands adhers to them, it will consist of both fines and clay instead of clay alone; and (e) when the wetted sample is patted in the palm of the hand, it will compact into a dense cake that cannot be penetrated readily with a blunt stick the size of a lead pencil.

. . .

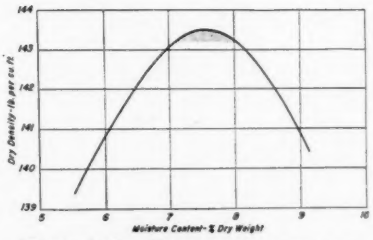
"Too many fines would cause the sample to fall apart when dried. Too much clay would leave the hand muddy after the wet sample was squeezed and would cause the wet sample, after being patted, to offer little resistance to the penetration of the stick."

Compact With Truck Traffic

To get a good job of surface consolidation on an existing road, then, material of the correct size should be added to give the road metal a proper gradation. The road should then be bladed to thoroughly mix the added material into the old road. With the proper amount of moisture present the new road surface can then be compacted. Compaction can be done with a special roller or with normal truck traffic. If optimum moisture can be attained, compaction by truck traffic is good. The problem here, of course, is to keep the proper amount of moisture in the mix during the compaction period.

After the road is compacted, it should be treated with about one lb of calcium chloride per sq yd of surface. Subsequent treatments of ½ lb per sq yd should be applied as needed. Generally two such treatments during a summer are adequate and the normal annual requirement is two lb per sq yd. This quantity will vary between geographic areas and is dependent upon the volume and weight of traffic.

Because the calcium chloride aids in conserving the aggregate placed on the road, usually it will not be necessary to add replacement material for years once the road surface has been consolidated. Results of a study completed in 1951 in Onondaga County, N. Y., presented by E. M. Baylard, Superintendent of Highways, at the



This typical moisture density curve emphasizes the narrow limits for maximum compaction

1952 Highway Research Board meeting, bring this fact out. This gravel-loss study covered a 16-year performance of calcium chloride consolidated roads and showed that the average loss of gravel per year was only 23.5 cu yd per mile. Compare this with an average yearly loss of 72 cu yd per mile in untreated roads as shown in an investigation by the University of Michigan over a four-year period.

Maintenance

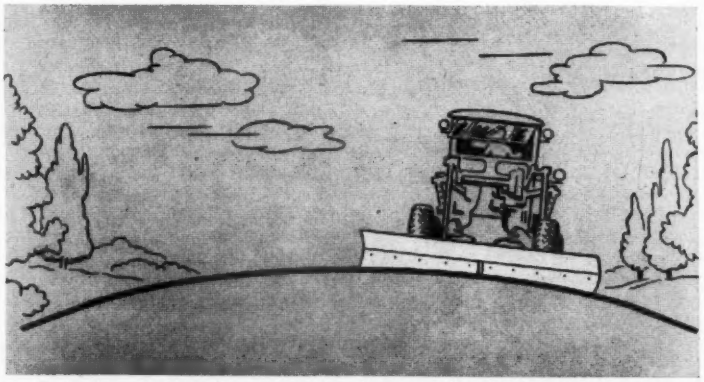
In any road, maintenance plays an extremely important part, and maintenance starts when the road is put down. The need for adequate drainage cannot be overemphasized. Ditches and culverts should be ample to carry water away from the road and they should be maintained as religiously as the road itself. Although moisture is needed to keep the road in good shape, no road was ever improved by standing water. A good crown should be built in the road and kept there. The circular or parabolic cross-section commonly used in pavement construction does not have sufficient side slope in the center of the roadway to properly drain storm water from a gravel or crushed stone surface. There is a tendency for pools of water to form on this comparatively flat surface, resulting in potholes. A modified "A" cross-section should be used in which the side slope is uniform at ½ in. per ft from center line to the edge of the road metal.

With a calcium chloride consolidated road, very little maintenance, other than periodic surface treatment, is required. Bladings are normally held to a maximum of four a year and it should not be necessary to add replacement material for many years.

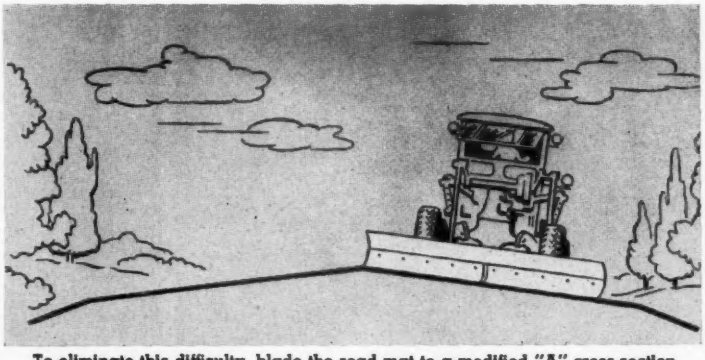
One advantage not yet mentioned is the minimizing of frost damage in calcium chloride treated roads. Research and field tests have shown that comparatively small percentages of calcium chloride are effective in reducing detrimental frost action.

It is important both for economy

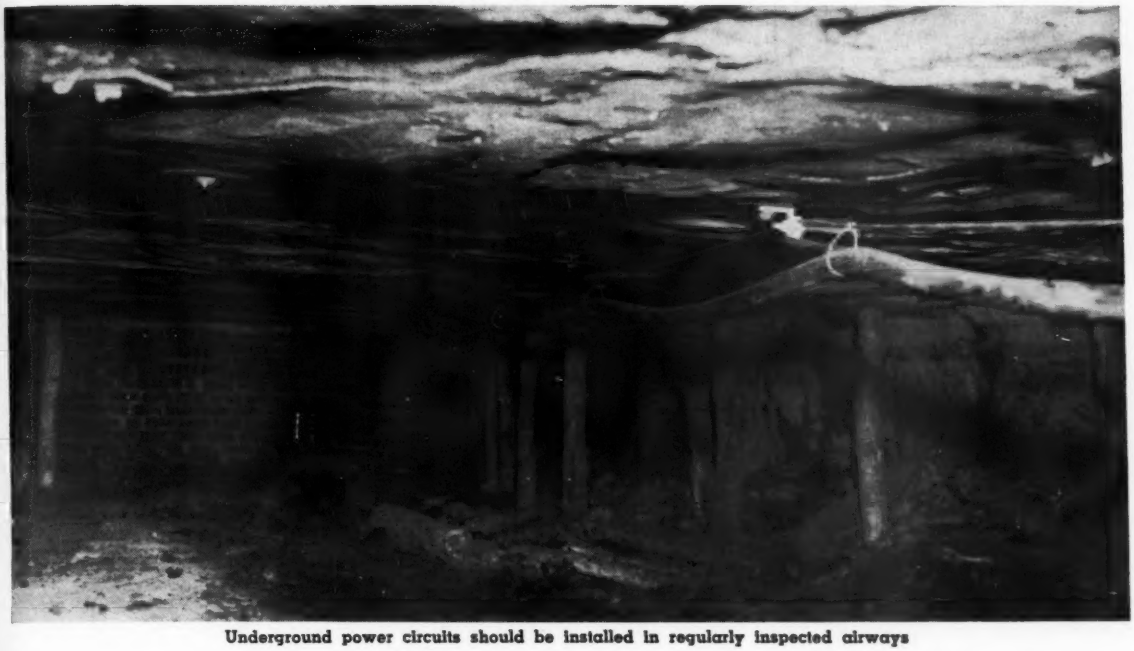
(Continued on page 73)



A circular or parabolic cross-section does not allow proper drainage from the center of the roadway. There is a tendency for pools of water to form there, resulting in potholes



To eliminate this difficulty, blade the road mat to a modified "A" cross-section in which the side slope is uniform at ½ in. per ft from center line to road edge



Underground power circuits should be installed in regularly inspected airways

Installation of High-Voltage Mine-Power Feeder Cables

A Report of the Subcommittee on Underground Power Recommends Types of Cables, Methods of Mine Installation and Suspension in Boreholes and Shafts

By T. R. WEICHEL, C. R. HUFFMAN and E. J. GLEIM

THE type of cable generally used for high voltage power circuits in mines may be classified as either metallic armored or non-metallic armored. The metallic armored type includes those in which steel wires, flat steel tapes or interlocking steel tapes are used to give protection against mechanical damage. Non-metallic armored cable has a fibrous armor and a tough neoprene sheath, or composition sheath, that provides protection against mechanical damage. The high voltage mine power cable described in this report is classified as a shielded non-metallic armored cable. Conductors are insulated with a high voltage insulation and shielded with a tinned copper shielding tape. Bare grounding conductors are placed in the interstices in contact with the shielding and the complete assembly is encased in neoprene. Cables of this construction have been used successfully for voltages up to 15 kv but most requirements in the past have been for five kv service.

This cable is suitable for installation in boreholes, shafts or horizontal runs in underground entries. It may be buried in a trench, placed on the mine floor, or suspended on insulators. It is a semi-portable cable that can be moved easily from one place to another and is suited to modern high-speed mining applications requiring frequent movement of the conversion equipment.

Federal and State regulations govern the installations of neoprene sheathed cables in most mines of the country. These rules differ in some respects but basic requirements are similar. The American Standards Association "Safety Code for Installing and Using Electrical Equipment in and About Coal Mines," Bureau of Mines Bulletin 514, covers most of these regulations and is used as a guide in selecting the proper type of cable and method of installation. Following are the committee's recommendations extracted from the ASA Safety Code that apply directly or indirectly to high voltage cables in underground coal mines.

Surface Installation

Power Circuits Leading Underground

Lightning Protection. Each outgoing power circuit leading underground shall be equipped with lightning arresters of approved type at the point where the circuit enters the mine. Lightning arresters on the primary

side of such circuits will be considered suitable for the secondary circuit on the surface for distances less than 100 ft. If the power circuits leading underground are 100 ft or more in length on the surface, suitable lightning protection shall be provided at the generating station or substation and also at the point where the circuit enters the mine.

Surface Disconnecting Switch. Each power circuit leading underground shall be provided with a switch or circuit breaker capable of opening each conductor of the circuit under full load. This switch or circuit breaker shall be placed on the surface not more than 500 ft from the point of entrance to the mine, unless equivalent control is readily accessible for opening the circuit in emergencies.

Overload Protection. All circuits leading underground from substations and transformer stations shall be provided at their source with current-interrupting devices of such capacities and so installed and adjusted that the circuit will be opened if the current in the circuit exceeds the safe carrying capacity of the conductors leaving the stations. Three-phase delta or wye-connected alternating-current circuits shall be protected by a fuse or an automatic circuit breaker in each ungrounded wire. Automatic circuit breakers to open all phases are recommended.

Cables for Shafts or Boreholes

High voltage power cables leading underground through deep shaft openings or boreholes usually are metallic armored and suspended by means of the individual armor wires. This type cable with steel-wire armor is undoubtedly the preferred one for permanent installation. It can be supported by the armor wires without strain upon the conductors and also affords protection against mechanical damage from falling material or moving equipment in the shaft. However, there are many installations where the protection of metal armor is not necessary or where the length of suspension is not enough to require support by armor wires. Installations of this type can be made with neoprene-armored cable and still satisfy safety requirements.

Cable Type. Cables in shafts, boreholes, and underground passageways shall be adequate for the service intended, installed in a permanent manner, and guarded against damage from external sources. The selection of type of cable, including the mechanical and electrical characteristics of the insulation and outer covering, shall take into consideration electric shock and fire hazards, deterioration from mine water and electrolysis, also means of suspending or otherwise supporting the cable.

Cable Insulation and Support in Shafts. All power conductors in shafts shall be covered with approved insulating materials throughout or guarded in an approved manner. Conductors shall be securely fastened in such a way as to support them properly. They shall be supported out of contact with combustible materials. When the length, weight, and construction of a shaft cable is such that suspension from its upper end only would subject the cable to possible damage, it shall be supported in an approved manner at such intervals as may be necessary to prevent undue strains in the sheath, insulation, and conductors.

Mechanical Protection of Shaft Cables. Shaft cables shall be so placed or protected that they will not be subject to damage from moving cages and skips, ice, coal, or other falling materials, nor to damage from mine water and electrolysis.

Borehole Cable Installation. All conductors passing underground through boreholes shall be installed in an approved manner that will prevent the occurrence of undue strains in sheath, insulation, or conductors, as well as damage by chafing of cables against each other or against the borehole casing.

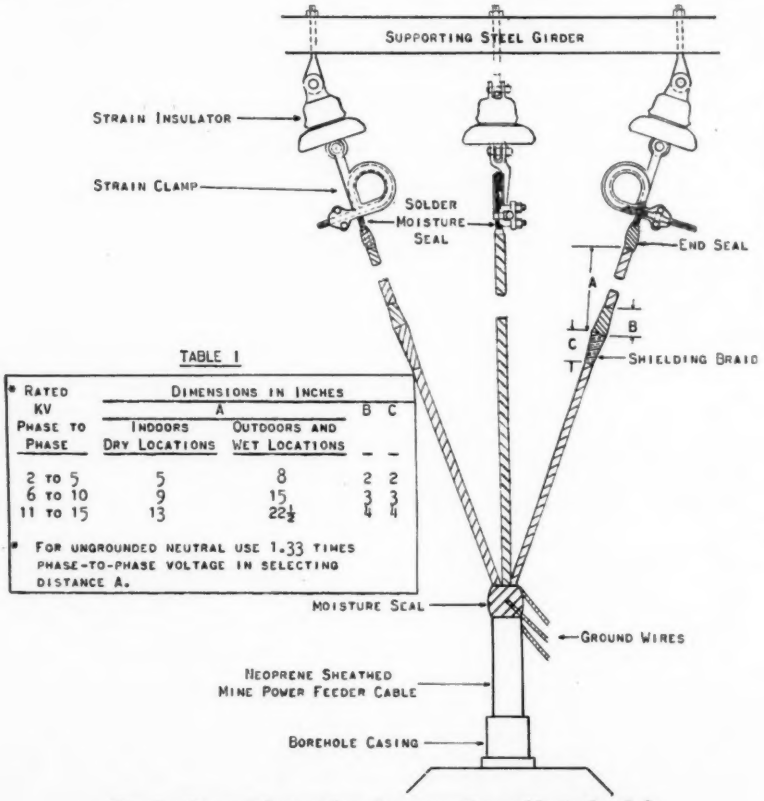


TABLE I

* Rated KV Phase to Phase	Dimensions in Inches A Indoors Dry Locations	A Outdoors and Wet Locations	B	C
2 to 5	5	8	2	2
6 to 10	9	15	3	3
11 to 15	13	22½	4	4

* For ungrounded neutral use 1.33 times phase-to-phase voltage in selecting distance A.

Fig. 1. Suggested procedure for supporting cable in borehole

Methods of Suspension for Non-metallic Armored Cables

Many installations have been made with single conductor cables such as direct-current feeders or low-voltage alternating-current feeders. With the possible exception of direct-current feeders, multi-conductor cables are preferred because of the added protection against mechanical damage and moisture as a result of encasing the cabled conductors in a neoprene sheath. In either case, the weight of the cable is supported by the individual conductors.

Following are two acceptable methods:

(1) Support the entire weight of the cable by clamping each conductor to a separate strain insulator. This method is used frequently and utilizes a bell-shaped casting over insulating material. Insulation is removed from the conductor to permit attachment of a clamp secured to the strain insulator. This strain insulator is anchored to the main supporting structure at the mouth of the shaft or borehole.

(2) Support by clamping the cable. This method consists of clamping the cable at the top of the mine shaft and at intervals throughout its length, if necessary. Clamping is very seldom used for borehole installations

as the total weight of the suspension is imposed on the clamp and cable at the top of the borehole. Metal or wooden clamps have been used for some installations. Excellent results have been obtained also with the basketweave cable grip. This is a woven-wire grip which clings to the cable sheath and tightens as tension is increased. The grip is anchored to a strain insulator at the top of the shaft or borehole or at intervals in the shaft if additional support is necessary. It should be of sufficient length and suitable for the specific cable diameter and weight to be suspended.

Whether the cable is supported by clamping over the cable sheath or by the individual conductors, the conductors are the supporting members. Grounding conductors should not be considered as aiding in support of the cable.

Undue strain in the cable sheath, insulation and conductor should be avoided when planning the cable installation and a suitable safety factor included. Safety factor is the ratio of breaking strength to stress and a factor of seven is recommended. Following is the formula for calculating safety factor of non-metallic armored cable:

$$SF = \frac{0.8\ A\ T}{W}$$

SF=Safety Factor

A=Area of three conductors in square inches (From table II).

T=Tensile strength of copper in pounds per square inch.

W=Wt. of cable in pounds

Tensile strength—

Soft drawn copper	30,000 psi
Medium hard drawn	50,000 psi
Hard drawn	60,000 psi

If the cable is installed in a shaft and it is not possible to obtain the desired safety factor, it may be necessary to support the additional weight by clamping at suitable intervals. This is not always possible, but in some instances it may be possible to clamp the cable to a galvanized steel messenger before it is placed in the borehole. Basketweave type grips or other suitable type clamp may be used but the material should be suitable to withstand corrosion.

Methods of suspension in which the cable is anchored around a sheave wheel are not acceptable because too much pressure is concentrated upon the actual surface of the cable touching the wheel and failure is encouraged. Preferably, the cable should be suspended by the conductors, unless the calculations have shown that the cable weight to be suspended is too great to give the recommended factor of safety. In that case, it may be necessary to use a steel wire armored cable in which the total suspended weight of the cable is sustained by the armor.

Table I—Area of Stranded Conductors

AWG	*Circular Mils*	*Square Inches*
6	26,250	0.021
4	41,743	0.033
2	66,373	0.052
1	83,694	0.066
1/0	105,534	0.083
2/0	133,079	0.105
3/0	167,800	0.132
4/0	211,600	0.166
250,000 CM		0.196
300,000 CM		0.236
350,000 CM		0.275
400,000 CM		0.314
450,000 CM		0.353
500,000 CM		0.393
700,000 CM		0.550
1,000,000 CM		0.785

Installation Methods

When installing borehole or shaft cable excessive bending of the cable should be avoided. The preferred procedure is to pull the cable up from the bottom of the shaft or borehole. The reel is placed at the bottom of the borehole or shaft and the cable pulled with a steel rope attached to the cable with a suitable pulling eye. A hoist, truck, or bulldozer is used to pull the rope and cable and relatively little bending of the cable occurs during installation operations because it is free to pull off the reel with very little tension. A sheave wheel of suitable dimensions should be provided at the mouth of the borehole or shaft for the pulling line. Strain insulators and clamps should be prepared beforehand to permit quick attachment to the cable conductors.

If cables cannot be pulled from the bottom, it will be necessary to drop the cable down the shaft or borehole. This requires elaborate braking arrangements on the reel with large sheaves for feeding the cable into the shaft or borehole. These reels are usually set some distance back from the opening so that the tension on the cable will not be excessive when the end is taken off the reel. Special means are frequently provided for holding back the end of the cable. A bulldozer or other equipment attached to the end of the cable is used to control lowering the final end into the borehole.

Another method has been used successfully for lowering cables in shafts. One end of the cable is anchored permanently at the surface and the cable looped into the shaft with a steel rope securely fastened to the free end of the cable. This method requires a large sheave wheel at the shaft opening, pulleys along the ground to permit easy movement of the cable, a truck to pull the cable into the shaft and a bulldozer to retard movement of the cable when the suspended weight becomes sufficient to pull the remaining cable into the shaft. The cable loop in the shaft should be at least as large as the diameter of the reel upon which the cable is shipped and in no instance should the cable be bent beyond the minimum safe bending diameter.

A most important factor to be considered before a cable installation is a good system for communicating between surface and underground crews. Movement of the cable should be observed at all times during installation and the operation stopped immediately if damage is liable to occur.

Terminating the Cable

Potheads are generally used to seal the cable end against moisture and to provide proper spacing and insulation between terminals. This method of terminating is not applicable where it is necessary to support the cable in the shaft or borehole by the individual conductors but it is suitable for terminating the end of the cable on the surface or in the mine. Shields and ground wires are terminated within the pothead. A stress cone is applied at the termination of the shielding within the pothead and grounding conductors and shields securely bonded to one another and terminated to the grounding terminal of the pothead casting.

When the cable is supported by the individual conductors in a shaft or borehole, care must be exercised in terminating the conductors and shielding and protecting the installation against the weather. Following is a suggested procedure illustrated in fig. 1.

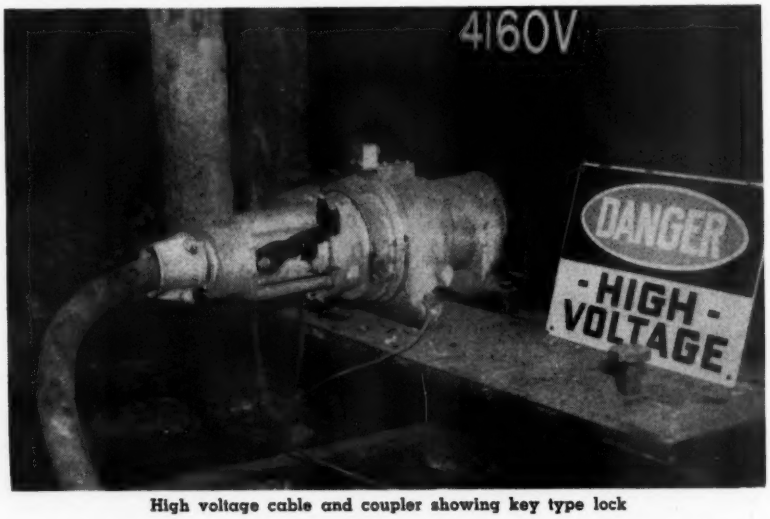
(1) Remove neoprene jacket to approximately one ft above end of borehole casing.

(2) Remove sufficient shielding tape, semi-conducting tapes, and insulation to permit installation of strain clamps.

(3) Moisture seal conductor strands by filling with solder for approximately one in. just above the insulation at the strain clamp.

(4) Suspend cable in borehole.
(5) To apply end seal, taper insulation, clean surface to be sealed, apply rubber adhesive cement and allow to dry. Wrap rubber splicing tape over solder-filled strand and tapered insulation to make adequate seal.
(6) Remove shielding tape and tape over insulation for distance A + C given in table I. Solder shielding braid to shielding tape as follows:
(a) Draw shielding braid tightly around shielding tape.
(b) Solder, avoiding damage to insulation.
(c) Unwrap shielding tape to edge of applied braid and cut. Remove tape over insulation for some distance. Clean thoroughly the surface from which the tape was removed.
(7) To build stress cone apply rubber adhesive cement for distance B + C and allow to dry. Using rubber splicing tape, build up insulation so that thickness of hand applied tape at center of cone is 75 percent of thickness of factory-applied insulation, and decreases uniformly to zero at both ends of cone. Cover cone with one layer of neoprene tape, or approved equivalent, half lapped. Shielding braid should be applied in tightly-drawn 1/16 in. lap wrappings to center of cone. Terminate braid by lapping several turns around conductor, soldering each lap.
(8) At end of neoprene jacket, wrap two or three turns of copper shielding braid around conductors and ground wires and solder so that they are bonded together.
(9) To apply moisture seal, pencil neoprene jacket, clean surface to be sealed, and apply rubber adhesive cement. Allow to dry. Apply rubber splicing tape as shown, keeping ground wires under tape, then bring out and bend sharply downward to form drip loop. Continue applying tape to make adequate seal. Cover seal with one layer of neoprene tape, or approved equivalent, half-lapped.
(10) Apply layer of neoprene tape, half-lapped in such a manner as to shed water from moisture seal at cable sheath to end seal of each conductor. Secure the end of the tape with several turns of friction tape or glass twine.
(11) Connect ground wires to system ground.

Termination of the cable at the base of the borehole or shaft may be in a pothead, circuit breaker or oil disconnect switch. Stress cones should also be included for terminating the conductor shielding. If possible, the stress cone should be located within the pothead or circuit-breaking device. The stress cone is made similar to instructions 6, 7, and 8.



High voltage cable and coupler showing key type lock

Underground Installation

Many factors must be considered in the underground installation of the high-voltage power cable, such as voltage and load requirements, length of circuit and permissible voltage drop, etc. These factors are generally the responsibility of the engineer, but the safety of the installation is of prime importance to all concerned. Following are the committee's recommendations based upon sections of the ASA Safety Code that apply directly or indirectly to the high-voltage cable described in this report:

Location. All underground power circuits other than portable cables shall be installed in a permanent manner and so located as to minimize possibility of damage by (a) mine water, (b) falls of rock and coal, or (c) movement of strata. Protection from damage by wrecked trips and blasts should also be considered.

It is recommended that power circuits shall be installed only in regularly inspected intake airways. Alternating current power circuits installed in the vicinity of trolley wires shall be covered or placed so as to minimize the possibility of being struck by current collectors.

Cables, High-Voltage. In selecting the type of cable and the mechanical and electrical characteristics of the insulation and outer covering, such factors as electric shock and fire hazards, deterioration from mine water and electrolysis, and means of suspending or otherwise supporting the cable must be considered.

Cables for high voltage circuits underground shall be either the metallic armored or non-metallic sheathed type. Metallic armored cables may be supported (a) on messenger wires or (b) directly on hangers, both of which shall be suspended by means of insulators if supported in coal or in other combustible materials, or (c) they may be buried. When conductors or cables are enclosed in metallic armor, conduit, or shields, the armor, conduit, or shields shall be electrically continuous throughout and effectively and permanently grounded.

Cable shall be installed on insulators placed at suitable intervals to avoid excessive sag or contact of the cable with combustible material. If there is danger from damage by moving equipment or roof fall, the cable should be buried in the mine floor.

Buried Cables. Power cables buried in the mine floor shall be not less than 12 in. below combustible material. Where such cables pass under mine tracks or where there is danger of crushing from the weight of passing trips or heavy equipment, they shall be buried in a trench at least 36 in. deep, or otherwise adequately protected by installation in a heavy metal conduit buried in concrete.

Before the cable is placed in the trench a layer of sand two to three in. in thickness should be made in the bottom of the trench. The cable should be placed on this bed of sand and covered to the top of the trench with sand. Sharp rocks or any fill with sharp edges should be avoided.

Disconnecting Switches. Disconnecting switches shall be installed in all main power circuits near the bottom of shafts, boreholes, and other places where these power circuits enter the mine. High-voltage disconnecting switches shall be accessible only to properly qualified persons and shall be arranged so they can be locked in the open position, or a danger sign must be placed on the switch by the person who opens it. Disconnecting switches also shall be provided near the beginning of all high voltage branch circuits.

Operators Corner

Selection, Care, and Handling of Industrial Hose

Industrial Hose . . . How Long Will It Last?

By CHARLES L. KENNY
Manager of Products
Quaker Rubber Corp.
Division of H. K. Porter Co.

This is a 64-dollar question — the answer, as with most manufactured goods, resolves itself between the manufacturer and the ultimate consumer. Quality materials and their precision fabrication are the manufacturer's prerequisites; while proper care, storage, careful maintenance, and of greatest importance, accurate information on conditions to be met, are the consumer's responsibilities. To insure proper care of industrial hose, a working knowledge of its basic components and the methods of its manufacture is a necessity. Therefore, a few words on these components and methods will not only benefit the consumer, but also justify the absolute need for careful attention to hose maintenance.

Three components of industrial hose are the tube, the carcass, and the cover. Manufacturing these components into the final product can follow three basic methods, each with its own set of advantages and each applicable to any type of industrial hose.

How Hoses Are Made

The wrapped hose process is a method of manufacture in which a rubber tube is stretched over, or hand-built around a 50-ft horizontal mandrel and multiple plies (depending on the specific requirements) of bias-cut fabric are wrapped on the tube. The fabric is rubber impregnated to insure maximum adhesion of tube, carcass, and cover. The rubber cover is then wrapped around the tube and carcass, over which a layer of cloth, the compression agent during vulcanization, is wrapped. This cloth is removed after the hose has been vulcanized.

Among the advantages of this method are the strength and flexibility it develops; the uniform inside (mandrel-made) surface; and the ability to furnish built-in rubber nozzles, as well as a wire reinforced carcass.

In the vertical or moulded-braided process a seamless tube is extruded in lengths up to 500 ft for sizes up to one-in. i.d. Larger i.d.'s up to 1½ in. are extruded in lengths up to 250 ft. Cords of cotton, rayon or various other reinforcement materials are braided around this tube. Layers of rubber friction are placed between the braids to insure adhesion of the three components, after which a rubber cover is extruded over the tube and carcass. Finally, a lead sheath is extruded over the uncured hose by a lead press machine to give uniform, continuous lengths of finished hose. The lead sheath is stripped off after vulcanization.

This moulded or vertical process develops an extremely flexible hose, insuring economy and uniform quality, due to the continuous length construction. The cover may be either smooth or corrugated, according to specification.

The third method is the horizontal braided process. Here, a seamless tube is extruded over a 50-ft mandrel and braids of steel wire, yarn, asbestos, cord, or other materials are applied to the tube under uniform tension. Both the angle of each end of reinforcement and the tension are accurately controlled. Layers of rubber friction are applied between the braids to insure adhesion of the components and to prevent chafing of the braids. Finally, a rubber cover is extruded over the tube and carcass, after which cloth, later removed, is wrapped on to compress the hose against the mandrel during vulcanization.

The horizontal braided process develops a superior handling, light weight, flexible hose. Its advantages include: high burst resistance; accurate control of expansion and elongation under pressure, and the ability to use a wide range of rubber compounds to suit the individual application. Most important, it guarantees close adherence to dimensions, minimum tolerances, and greater assured strength.

There is a proper hose for every job

Things to Consider

When ordering hose, careful consideration should be given to the conditions surrounding its use. The first step toward care and handling is accurate information on fluid to be conveyed, working pressures, and the existing outside elements. All available information on the fluid to be conveyed will determine the compounds to be used in manufacturing the tube —e.g. where water is the element, ordinary rubber would be a sufficient carrier, whereas in the case of highly volatile gases, special compounds are required. The strength of the carcass depends on the working pressure of the fluid. A high pressure demands a stronger hose. It is best to choose a hose in which the estimated pressure "to burst" is at least four times the intended working pressure. In some cases, such as when working with superheated steam, a hose with a burst pressure of as much as ten times the working pressure is recommended. Finally, the outside elements to which the cover will be exposed should be known.

Hoses vary greatly in many respects and for maximum performance, they should be as light, as flexible, and as easy to handle as pressure requirements will permit. Consideration of these details may demand a higher priced hose, but the greater safety and longer life afforded will result in maximum economy in the long run.

Do's and Don't's

Now that the right hose has been chosen, a definite responsibility rests on the user's shoulders to assist in lengthening its life. The following list of Do's and Don't's, if followed, are guaranteed to lengthen the life span and increase the efficiency of industrial hose.

(A) DON'T store hoses near generators or electric motors. The smallest amount of free ozone has a definite oxidizing effect on all rubber compounds.

(B) DO store hoses in a cool, dry area, coiled on a flat surface. The coil diameter should be approximately 25 times the i.d. of the hose. Hoses with helix wire reinforcement, for example gasoline and suction hose, should be laid straight.

(C) DON'T hang hoses over sharp hooks. This will tend to deform the rubber permanently, causing cracks and weak spots when the hose is straightened out under pressure.

(D) DO inspect the hoses regularly. Careful inspection, looking especially for abuses and excessive wear can prevent the most costly breakdowns—those which interrupt production.

(E) DON'T shut the hose off at the nozzle. Bottling the elements being conveyed in the hose only retains high pressures and temperatures unnecessarily and leads to premature breakdowns of the hose.

Hose is the lifeline for more and more pieces of mining equipment

(F) DO turn the hose end for end, so that alternate positions will be exposed to destructive elements, e.g. in many cases, only a small section of the hose will be exposed to abuses. Service life may be lengthened by this alternating procedure.

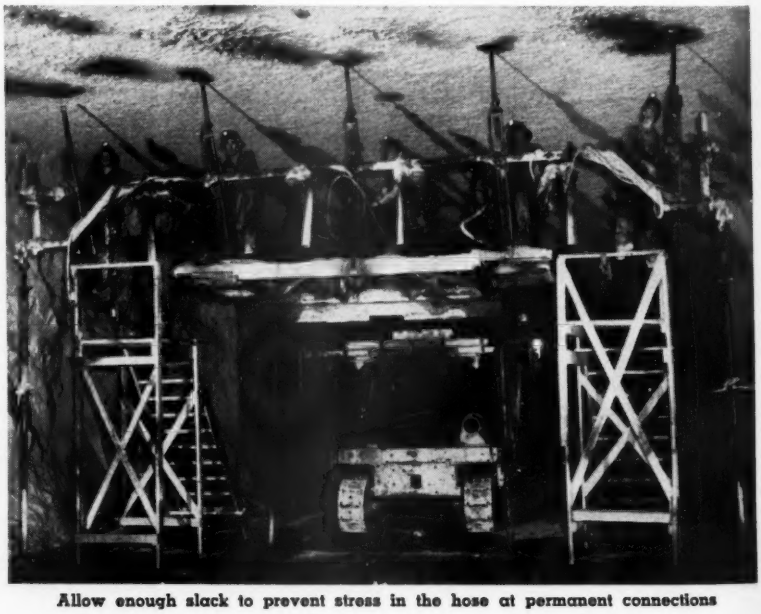
(G) DON'T drag or pull the hose over rough surfaces. Plan your operation so that a minimum of hose movement is required.

(H) DO clean out sludge and dirt when you have finished using the hose.

(I) DON'T subject hose to more working pressure than it is built to withstand. This protection can avoid bursts which at times are responsible for serious accidents.

In the care of hose, attention to the connection of lengths is an important feature. Hoses with fixed connections should be sufficiently long to provide a natural loop or free-hand between the connections. This lessens the possibility of the shank part of the coupling cutting through the tube into the carcass. It will also allow for natural hose contractions under pressure. For example, some moulded hose connections contract as much as 10 percent under pressure. On short hose sections with fixed connections, it is important that the hose connection be straight. A hose connection with a twisted or partially spiralled carcass will be subjected to destructive stresses.

Finally, and perhaps of greatest over-all importance is attention to the proper coupling and its installation. Regular check on fittings for tightness and excessive wear is essential. If hose ends become damaged by clamps at the fittings, the hose should be cut back and fittings reapplied where a new, sound connection can be made.



Allow enough slack to prevent stress in the hose at permanent connections

Wheels of GOVERNMENT

AMC

As Viewed by HARRY L. MOFFETT of the American Mining Congress

CONGRESS is picking up steam in its drive to write into law the major planks in the President's legislative program before adjournment in late July. Some hints have been dropped by Administration leaders that Congress may only recess at that time, to permit members to return home for the political campaigns, and that they may then be called back in the fall to wind up their work.

While the House took time out for an Easter vacation, the Senate continued to grind away on legislative proposals, both in committees and on the floor, in an endeavor to cut down the backlog of measures before it.

Meanwhile the eyes of Congress, the Administration and the nation are centered on the Geneva Conference on the Indo-China situation, which might well be the turning point between peace and further spread of that war. Results of the conference may determine how much pressure will be brought to bear to increase defense preparations with accompanying demands for heavy financial outlays.

In this background of international tension, the Commerce Department has instituted a simplified system of priorities and allocations covering needed materials for defense and Atomic Energy contracts, and at the same time has established the framework for another Controlled Materials Plan should an emergency develop.

Trade Policies Under Fire

The President's foreign trade program is likely to come under heavy fire on Capitol Hill. He has told Congress that he wants authority for a three-year period to reduce tariff rates by five percent a year, or to cut rates by up to 50 percent on commodities which are imported in negligible quantities, or to reduce to 50 percent ad valorem those rates which now exceed that figure. He has said, however, that he wishes to maintain the peril point and escape clause provisions of the present law. Since the Reciprocal Trade Agreements Act is due to expire June 12, this program is likely to be considered at the current session.

Even stalwart Administration supporters have expressed opposition to the President's proposals to expand our foreign trade at the expense of some domestic industries, and a bumpy road lies ahead for the program. Large segments of domestic industry which have suffered serious unemployment are calling upon Congress for action to prevent further harm, and in an election year these calls are likely to fall upon responsive ears.

Meanwhile, Senator Henry Dworshak (Rep., Idaho) has introduced a bill which would limit, by quotas, imports of lead and zinc metals, ores and concentrates to the historic levels of such imports. He said that passage of such a bill is necessary to protect the security interests of the United States by stimulating domestic production of the two metals. Introduction of his bill drew fire from Argentina newspapers which, while declaring that there was some justification for such a measure in the United States, contended that adoption of such restrictions would contradict U. S. foreign trade policies and could bring about major depressions in Latin-American countries. Similar bills have also been introduced in the House. All are likely to be considered at the time the extension of the Reciprocal Trade Agreements Act is under discussion.

Domestic coal producers are likewise suffering from heavy imports of foreign residual oil and a strong drive will be made to restrict such imports through the imposition of quotas.

Lead-Zinc Report

On April 20, the U. S. Tariff Commission finally reported to the House Ways and Means and Senate Finance Committees its findings in its general investigation of the depressed situation existing in the domestic lead and zinc mining industries. The findings were solely ones of fact and no recommendations as to legislative solutions were made.

The Commission, in a series of 26 "Conclusions," found that the domestic industries had been adversely affected by heavy imports, by the steel strike in the United States, and by the dumping of British Government-owned surplus stocks of the two metals. It also found that employment in the two domestic industries had declined sharply in 1952 and 1953, that operating profits before taxes had been drastically reduced, that production costs had risen, and that the value of the products had fallen off.

The Commission left to Congress the decision as to what relief should be provided, declaring that this is a matter of public policy within the realm of Congressional authority. The fact-finding agency pointed out that the existing tariff rates on lead and zinc were made effective by concessions granted by the U. S. in the General Agreement on Tariffs and Trade (GATT) and that so long as these concessions remain in force "the enactment of legislation imposing increased import restrictions on these articles would be inconsistent with international commitments of the United States." It did say that the President could act under the "escape clause" of that agreement and the trade agreements law, to restore the original rates of 1930 or increase existing rates up to 50 percent above those existing on January 1, 1945, and/or impose quantitative limitations on imports.

In its final finding the Commission came close to suggesting how Con-

Washington Highlights

TRADE PROGRAM: Under fire.
LEAD - ZINC: Tariff Commission Reports.
TAXES: Finance hearings held.
T-H REVISION: Questionable.
SEAWAY: In Rules Committee.
STOCKPILE: Goals lifted.
GOLD: L-208 reviewed.
MINING LAWS: Oil-mining conflicts studied.

gress could meet the situation. It said that if legislation were to contain a recital to the effect that an emergency in international relations exists and that import restrictions are necessary for the protection of the United States, then the legislation would not be inconsistent with U. S. commitments in the GATT.

The Commission has not yet reported on the plea of the National Lead-Zinc Committee for relief under the "escape clause" provisions of the law but is expected to do so before the deadline date of June 13.

Senate Studies Taxes

The Senate Finance Committee is holding hearings on the Administration-supported measure to revise the Internal Revenue Code. In mid-April AMC Tax Committee Chairman Henry B. Fernald complimented the committee and the House for the excellent job done in revamping the present law.

With respect to percentage depletion he urged amendments to remove the uncertainties and negative burden of proof called for in the House bill, as well as in the provisions relating to definition of a "mineral property." He also called for Congress to reverse a recent court decision and to stipulate that oil treatment for coal to allay dust and anti-freeze treatment be recognized as includible processes for computing percentage depletion.

Fernald asked the committee to remove the $75,000 limitation and the four-year limitation on deductions for exploration expenditures, to permit expenditures for facilities for abatement of water and air pollution to be written off in not more than five years, to approve the liberalized depreciation provisions of the House bill, and called for adoption of proposals dealing with consolidated returns, corporate distributions and liquidations, carry-over of charitable contributions, foreign income, and repeal of the silver bullion tax.

Other mining witnesses urged an increase to 40 percent in the percentage depletion allowance for uranium.

Meanwhile the President has signed the bill reducing excise taxes.

T-H Revision Stymied?

While the Senate Labor Committee has approved a measure, much along the lines of the President's wishes, for revising the Taft-Hartley Act, the House Labor Committee has not yet reported out a bill for changing the law. The House Committee is in somewhat of a hassle over whether or not to give Federal courts jurisdiction over labor dispute cases rather than let them be handled by the National Labor Relations Board. It has, however, nearly completed action on all other phases of a revised measure.

Proposals approved by the House Committee would strengthen the national emergency provisions of the law, shore up the secondary boycott provision, liberalize free speech, require employers as well as unions to file non-communist affidavits, call for a pre-strike ballot, and require that union financial and organization reports be made public by the Secretary of Labor.

The Senate Committee failed to agree on a secret strike ballot but this matter is likely to be the subject of extensive floor debate. The remainder of its bill closely parallels the recommendations of the President. Heated debate is likely on a move by Senator Goldwater (Rep., Ariz.) and others to strengthen the power of States to deal with labor disputes. A move is likely to be made in the upper chamber to recommit the bill.

The legislation is not likely to receive final Congressional action at this session unless the White House steps in with all of its persuasive powers. It is understood that the President wishes to carry out his campaign promises and revise the law, but without heavy pressure from him this is considered unlikely at the present time.

St. Lawrence Fought

The St. Lawrence Seaway bill still remains locked up in the House Rules Committee. Opponents of the measure have told that committee that the bill would severely damage the country's railroads, coal industry, and east coast seaports. So strong has been the opposition that the Rules Committee has sidetracked consideration of the measure until after its Easter vacation. Chances are that the Administration can muster enough votes to have the bill brought before the House and if this is done the controversial measure may be approved after a fight of more than 20 years.

Stockpile Reviewed

Late in March the President told the Office of Defense Mobilization to establish new long-term stockpile objectives and to give preference to newly-mined metals and minerals of domestic origin in fulfilling any increased goals.

ODM estimated that some 25 to 40 goals would be increased, with particular attention paid to domestic mining industries suffering depressed conditions.

The President told ODM that all materials acquired under any new programs would be held under the safeguards provided by the Stockpile Act. No announcement has as yet been forthcoming from ODM as to the new goals but one is expected shortly.

Western Senators expressed approval of the Presidential directive but pointed out that it was not a long-range solution to the critical problems faced by various domestic mining industries.

Free Market for Gold

The Senate Banking and Currency Committee has held a series of hearings on a number of measures seeking to restore a free market for gold, the gold standard, and one to place the United States on a bimetallic monetary standard.

Treasury officials opposed the measures, stating that restoration of the gold standard was not feasible until more progress had been made in removing international trade restrictions and until convertibility has been restored among the principal currencies.

Mining industry witnesses, leading bankers and economists, and monetary experts endorsed the various bills.

Donald McLaughlin, chairman of the Gold Producers Committee of the American Mining Congress, urged the adoption of a free market for gold and a return to the gold standard. He also suggested that a Joint Congressional Committee could well recommend a new dollar-gold ratio after hearing the views of qualified witnesses.

It is expected that the committee will take some time in preparing its report and recommendations.

Meanwhile, Commissioner Day of the U. S. Court of Claims has reported his findings of fact in nine cases involving gold mines closed down in 1942 as a result of WPB's L-208 Order. He found that the closing order deprived the Homestake Mining Co. and six others of the use and benefit of their properties. The findings are now before the full Court of Claims for consideration. They will probably be argued before that Court at its October session.

The Court will have the task of determining whether or not the Government is liable for damages and other financial losses occurring as a result of the WPB order. Should the Court hold the Government liable, then each gold mining company that has filed its case will have a chance to present its claim for the specific damages sustained. A total of 127 cases are now pending before the Court.

Based on the findings in the Homestake case it is indicated that the Government will be found liable for damages. The Commissioner in this case specifically said that the company had been deprived of its use and benefits of ownership and that no compensation was paid for closing its mine.

Public Lands

Legislation dealing with mining and other operations on the public domain is springing to life in this session.

(Continued on page 68)

AMC Personals

Several changes in management personnel were announced by Bunker Hill & Sullivan Mining & Concentrating Co. following a recent meeting of the Board of Directors.

Stanly Easton, company president since 1933, has retired from that position and will become Board chairman. Easton first joined Bunker Hill in

Stanly Easton

J. B. Haffner

1894. He was manager of operations at Kellogg, Idaho, from 1903 to 1927, first vice-president and general manager at Kellogg from 1927 to 1933, when he became president.

J. B. Haffner, formerly general manager of Bunker Hill at Kellogg, is the new company president.

P. C. Feddersen, general smelter superintendent, succeeds Haffner. Feddersen in turn is succeeded by **Harold E. Lee** formerly superintendent of metallurgy and research.

John D. Bradley of San Francisco, a company director, was elected to the new office of executive vice-president at the Board of Directors meeting.

Charles A. Barrett, former general mine foreman at Helen No. 9 mine of Eastern Gas & Fuel Associates, has been transferred to the company's Keystone mine as general mine foreman over a portion of that mine. He will share the duties of general foremanship with **W. L. Laxton,** who was transferred to Keystone upon the closing of the Carswell mine.

Directors of The M. A. Hanna Co. at their annual meeting, April 6, elected **Walter A. Marting** a vice-president and advanced **W. C. Pieper** from assistant treasurer to treasurer. Marting came to Hanna in January, 1953, from the law firm of Jones, Day, Cockley and Reavis. He is also a vice-president of Iron Ore Co. of Canada. Pieper has been with the company since 1943 and was made assistant treasurer in 1952.

Promotion of **I. A. McAdoo** to the post of assistant general superintendent for Sterling Smokeless Coal Co., Whitby, W. Va. and its affiliate, Mount Hope Coal Co., Holcomb, W. Va., has been announced. McAdoo has been with the two companies for about 10 years as chief engineer, a position he still retains.

Appointment of **Christian F. Beukema** as vice-president of Michigan Limestone Division was recently announced by Hugh S. Lewis, president of that division of United States Steel Corp. Beukema has been general manager of operations of the division for the past year.

A. Vernon Sproles, general superintendent of Pocahontas Fuel Co. since 1944 has been elected vice-president in charge of operations for the company. **P. P. Ferretti,** formerly assistant general superintendent, succeeds Sproles as general superintendent of the company.

Howe Sound Co. has announced two recent changes in staff personnel. **E. D. Haddon** has been appointed chief accountant for the Calera Mining Co. at Cobalt, Idaho. **R. Scott,** formerly with Howe Sound Exploration Co., Ltd., succeeds Haddon as chief accountant at Howe Sound Co., Chelan Division, Holden, Wash.

J. E. Westenberg has been named director and chief resident engineer of Lone Star Sulphur Corp.

Jacob Blecheisen recently was elected president and a director of the Rosiclare Lead and Fluorspar Mining Co., Rosiclare, Ill.

George R. Beehler was recently named general manager of Glen Alden Coal Co. Before his promotion, Beehler had been assistant to William W. Everett, vice-president of operations for the company. He joined Glen Alden in 1922 after having worked for a short time in the gold fields at Cripple Creek, Colorado, and with the Lehigh Coal & Navigation Co. and Hudson Coal Co.

Neilsen B. O'Rear, formerly information specialist for the U. S. Bureau of Mines at its Washington office, is now with the U. S. Atomic Energy Commission at the Grand Junction operations office, Grand Junction, Colo.

Several promotions and personnel changes have been announced by the Universal Atlas Cement Co. Directors of the U. S. Steel Corp. subsidiary elected **Fred T. Wiggins** to the newly created office of vice-president—commercial; **James C. McClure** to vice-president and general sales manager; and **Henry C. Schmielau,** currently comptroller, to the additional office of vice-president. **Mac H. Hull** was appointed assistant to president and **W. Owen Lawrence** was made general operating manager for the company.

At the same time two appointments in the operating department of the company's Buffington, Ind., plant were announced. **Archie H. Adams** is now plant manager and **Roald W. Nygaard,** formerly supervisor—industrial relations, was named assistant plant manager.

Charles A. Gibbons has been appointed president of Susquehanna Collieries Division of The M. A. Hanna Co. He has been with the company since 1931, when he was appointed mine manager of Susquehanna Collieries Co. in the anthracite fields.

In 1937 he was elected to operating vice-president of the company and then upon the merger of the company into The M. A. Hanna Co. in 1947 was elected vice-president and general manager of the Susquehanna Collieries Division. In 1948 he was given additional duties as director of sales of the Anthracite Division.

J. W. Woomer & Associates, consulting mining engineers, have opened enlarged offices in the Henry W. Oliver Bldg., Pittsburgh. Their old office was in the Union Trust Bldg. in Pittsburgh.

A. J. McNab, president and chief executive officer of Magma Copper Co. and its subsidiary, San Manuel Copper Corp., has been elected chairman and chief executive officer of both companies.

He has been succeeded as president of Magma and San Manuel by **Wesley P. Goss,** who also will retain the general managership of the properties in Arizona. Before his promotion Goss had been vice-president and general manager of the two companies.

Alfred M. Esberg, a director and a vice-president of American Potash & Chemical Corp., resigned from that company February 28.

R. C. Collier has been named superintendent of the Hendrix mine of Consolidation Coal Co. (Ky.).

Victor Hollister, geologist for American Smelting and Refining Co.'s Northwest Mining Division, has joined the staff of the Northern Peru Mining and Smelting Co., a wholly-owned Asarco subsidiary, in Peru.

Officials of the Lillybrook Coal Co. have announced the appointment of **Nimmie Maloney** to the post of general mine foreman at its Killarney mine, in Raleigh County, W. Va. At the same time **William C. Blizzard** was named general night foreman.

It has been announced that **H. R. Barker** will be plant manager of the Lone Star Sulphur Corp. when the firm gets into production at Long Point dome in Fort Bend County, Texas.

At a meeting held March 17, the directors of Truax-Traer Coal Co. elected **Gregory S. Devine,** vice-president in charge of sales, a director of the company.

George T. Harley, manager of the New Mexico properties of the Potash Division of International Minerals & Chemical Corp. since 1944, became consultant for the Potash Division on January 1, 1954. Succeeding him as manager is **Carl A. Arend,** who has been assistant manager. The Potash Division's mine and refinery are located at Carlsbad, N. Mex., and Harley will retain his offices at the plant.

G. T. Harley

Charles Hamilton Chase, for several years assistant general manager of Vulcan Iron Works, Denver, Colo., has been promoted to general manager, succeeding **R. A. Fox,** who has retired.

William R. Steadman has been appointed general superintendent of Frick district mines of U. S. Steel Corp.'s coal division. Stedman was general superintendent of the Gary (W. Va.) and Lynch (Ky.) district of U. S. Steel's coal division and has been succeeded by **Woods G. Talman,** former assistant superintendent.

Succeeding Talman is **Charles W. Connor, Jr.,** who has been with U. S. Steel since 1942 and who is a former assistant superintendent of Leisenring No. 1 mine, near Connellsville, Pa.

August R. Werft was named assistant general superintendent of the Frick district. He has been chief engineer and has been succeeded in that position by **Jesse F. Core.**

Arthur H. Bunker, president of the Climax Molybdenum Co., recently announced that **Carroll L. Wilson** has been shifted from the presidency of the Climax Uranium Co. to devote full time to his post of director of industrial development of the parent company. He will retain his connection with the uranium company as a member of its board of directors.

John H. White, Jr., has been elected to succeed Wilson as president of Climax Uranium Co. and the presidency has been made a full time post with headquarters in Grand Junction, Colo.

R. E. Zimmerman recently resigned from the U. S. Steel Corp., Coal Division to become a vice-president of the Paul Weir Co. in charge of coal and mineral beneficiation. He will make his headquarters at 20 N. Wacker Drive, Chicago 6, Ill.

Allen D. Christensen was elected president of Utah Construction Co., succeeding **Lester S. Corey.** Corey has served as president since 1940 and has been associated with the company for 53 years.

—*Obituaries*—

L. Ebersole Gaines, 61, president of the New River Co., died unexpectedly April 16 at Mount Hope, W. Va. He had served as president of the coal company since 1939. For the past 13 years he had also been president of the West Virginia Coal Assn.

A native of Fayetteville, W. Va., Mr. Gaines practiced law there after graduating from Princeton University in 1916. In the 1930's he engaged in various industrial activities and in 1935 was named vice-president of Amherst Coal Co. and Logan County Coal Corp. In 1939 he became president of the New River Co., largest coal mining firm in the New River district.

L. E. Gaines

Phillip R. Lynch, 70, died March 21 at Silver City, Texas. Mr. Lynch was a widely known mining engineer and executive of the Phelps Dodge Corp. at its Burro Mountain operations for 30 years. He retired in 1945 as superintendent of copper leaching operations at Tyrone, Texas.

Charles T. Van Winkle, 81, retired president of the Rico Argentine Mining Co., Rico, Colo., died in Salt Lake City, March 29.

Horace M. Lawrence, 64, for 23 years a national leader in the field of standardization projects for building codes, construction operations, materials and mining for the American Standards Association in New York, died at Teaneck, N. J., on April 6.

Mr. Lawrence was graduated from MIT in 1913 and worked in mining and metallurgical engineering across almost the entire North American Continent. He was well known in this field for his achievements in ore concentration. He came to the association after five years' service with the United States Bureau of Mines.

Lloyd M. Kniffen, 70, commodity specialist in the U. S. Bureau of Mines, Foreign Minerals Division, died late in March in Washington, D. C. Mr. Kniffen had a long career as a mining engineer and geologist. He was active in mining in New Mexico and oil development in Texas.

William H. Cooke, 55, general manager of the Jewell Ridge Coal Co. at Peach Creek, W. Va., died March 29 when his private single-engine airplane crashed near Logan, W. Va. Mr. Cooke was attempting to land in a high wind.

Lawson H. Bauer, 65, chief of the chemical department of the New Jersey Zinc Co. at Franklin, N. J., died on January 27. Mr. Bauer joined the company as a chemist in 1913 and became chief of the chemical department at Franklin in 1951. He was a graduate of Lafayette College, a fellow of the American Mineralogical Society and a recognized authority on minerals of the Franklin area.

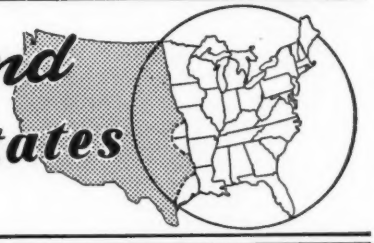
Karl M. Leute, president of Lithium Corp. of America, Inc. and also president of Manganese Chemicals Corp., both of Minneapolis, Minn., died March 24 in Phoenix, Ariz.

In 1937 Mr. Leute founded Electro Manganese Corp. and erected the first successful commercial plant for the production of electrolytic manganese. In 1942 he founded Metalloy Corp. which was later to become Lithium Corp. of America, Inc.

In 1950 Mr. Leute formed Manganese Chemicals Corp. to produce manganese compounds from low-grade ore in Minnesota.

NEWS and VIEWS

Eastern and Central states



Atomic Power in Pittsburgh

The first electric plant powered by atomic energy will be built and operated by Duquesne Light Co. in Pittsburgh, the Atomic Energy Commission has disclosed. Output will go into the company's power system and be marketed to its customers. Construction of the plant is expected to take about two years.

Westinghouse Electric Corp. will build the plant and expects it will have a 60,000 kw capacity. Designed gross heat output will be 900,000,000 Btu per hour. The reactor will produce steam at about 600 psi.

Freedom Award

The Lorain-Lorado Journal, employe publication of The Lorain Coal and Dock Co. and The Lorado Coal Mining Co. and its editor, Harry C. Walter, have again received Honor Metal Awards from *Freedoms Foundation* at Valley Forge, Pa., for outstanding contribution to a better understanding of our American Way of Life during 1953.

This marks the fifth Freedoms Foundation Award received by the Lorain-Lorado companies in the last four years. Stanley B. Johnson, president, won a Fourth Place Award in 1950 for his editorial, "Faith of Our Fathers", and a Second Place Award in 1952 for his editorial, "The Strength Of Our American Way". Both of these editorials originally appeared under his "President's Corner" in the Lorain-Lorado Journal, which also won a Second Place Award in 1950, and a Certificate of Merit Award in 1952 in the employe publication category.

Opening New Coal Field

A. T. Massie Co. is developing three mines in a virtually untapped field of high-grade Sewell and Fire Creek coal on the headwaters of Manns and Glade Creek in Fayette County, W. Va. Present plans call for the mining of 3000 tpd of coal from the Fire Creek seam and 1000 tpd from the Sewell.

Roberts and Schaefer Co. have been awarded a contract for the construction of a coal cleaning plant near Clifftop, W. Va. The plant is scheduled to go into operation next August.

The New York Central and Chesapeake and Ohio railroads are building an 18.5-mile rail extension to the new field. There will be 13 miles of mainline track and 5.5 miles of siding. Coal will be hauled four miles from mines to the cleaning plant, processed and then reloaded for shipment to market.

All Safe But the Birds

Pittsburgh Coal Co., Division of Pittsburgh Consolidation Coal Co., continues to reward its miners for safety. The year 1953 marked the eighth consecutive year in which that company presented turkeys to eligible employes as safety awards. In all, 3837 birds were distributed to employes of the company. Turkeys are given to workers who have had an accident-free year and who are employed at operations having good safety records for the year.

Alumina Facilities Expand

Expansion of the alumina producing facilities of the Aluminum Co. of America at its Mobile Works has been completed. The expansion project increased the plant's production capacity by 33 percent. According to Works Manager Duncan C. Smith, the plant can now produce sufficient alumina from bauxite for smelting into more than 400,000 tons of aluminum annually.

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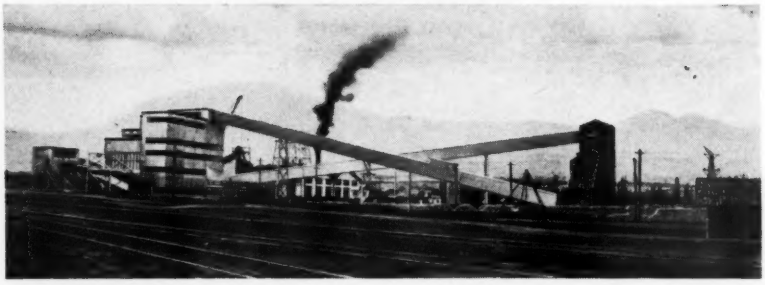
Build Turkish Cleaning Plant



A new and ultra-modern coal preparation plant, located at Soma, Turkey, has just started operating under the management of Eti Bank of Ankara. The industrialization of Turkey has led to an increased demand for fuel of a high degree of perfection. The demand for coking coal for metallurgical purposes has added impetus to the building of a plant that would supply coals for industry, as well as metallurgical coal. The new washery was designed, equipped, and erected by McNally-Pittsburg Mfg. Corp., Pittsburg, Kans. The fully automatic washing equipment consists of coarse coal and fine coal washers of the Baum jig type.

The coal is dried in two centrifugal dryers to a surface moisture of not exceeding four percent. The new washery is equipped to produce 165 tph of coal.

Wheels of Government

(Continued from page 64)

Measures have been introduced in both the House and the Senate to resolve the conflict between the mining laws and mineral leasing laws of the United States, which has become acute in the case of fissionable source materials, and is of wide importance in the western States.

Representatives of the oil and gas industry and the mining industry developed proposals which would take into account the problems of both industries on public lands and adequately protect the public interest. The bills which resulted from their proposals would permit the location of mining claims on lands which are subject to the mineral leasing laws, and would subject future mining locations to a reservation to the United States of all Leasing Act minerals and the right to recover them. Full patent rights would be given to mining claims located for fissionable materials.

Considerable interest in the adoption of such a measure is being shown on Capitol Hill. It is anticipated that hearings will be held this month and that Congress will adopt some measure at this session.

Meanwhile, a complete revision of the Atomic Energy Act is before the Congress. It likewise carries a provision granting the right to locate mining claims for fissionable materials and to carry them to full patent, but reserves the right of the United States to get production of the materials if needed.

Secretary of Interior Douglas McKay has renewed his request that Congress approve the D'Ewart-Dworshak bills which would bar abuses of the mining laws, without disturbing the basic principles of these laws. No action has been taken on these measures thus far at this session.

Treat Virginia Manganese

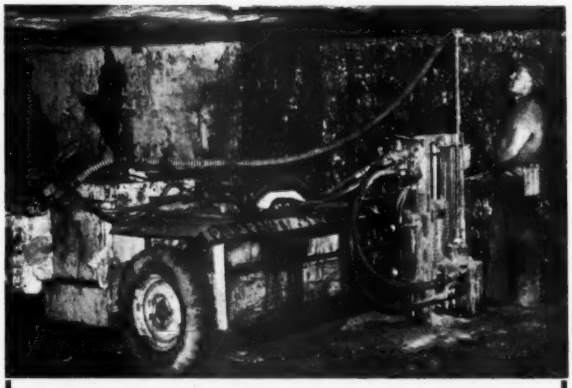
Union Manganese Co. of Pittsburgh, Pa., is erecting a washer at Tazewell, Va. The washer is to treat manganese ore now being mined by the company at Sugar Grove, Va.

Improvements At Universal

Universal Atlas Cement Co., Division of United States Steel Corp., put a new raw material process into operation at Pittsburgh, Pa., on January 18. The new unit eliminates a large portion of the smoke and dust that was put out by the previous unit.

This is but one step in a major rebuilding program at the company's Pittsburgh plant. When the modernization program is completed late in 1955, the new plant will have only two major smokestacks instead of the seven there now. All smoke funnelling through these two stacks will be cleaned by mechanical dust collectors and then by electrostatic precipitators.

Rebuilding of the plant involves the razing of the coal mill, raw mill, kiln and finishing mill, and the replacement of all these facilities with new modern units. When the building program is completed, this equipment will enable the plant to reduce smoke emitted by more than 90 percent.



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Coal Dock For Atom Plant

Contract for the construction of a river dock to handle barge shipments of some 2,000,000 tons of coal annually to provide power for an atomic energy plant, has been awarded to Dravo Corp., Pittsburgh.

The facilities are to be built along the Ohio River at Yankeetown, Ind., 15 miles east of Evansville. Coal will be transported upstream to the new power plant of the Ohio Valley Electric Co. at Madison, Ind., after moving six miles via a new railroad to the Ohio River from strip mines near Boonville, Ind. The utility is one of several to supply electricity for an atomic energy plant in the Portsmouth, Ohio area.

Dravo engineers stated the new harbor will extend more than half a mile along the shoreline. It will accommodate thirty 195-ft hopper barges, each capable of carrying 1500 tons of coal. The round trip between Yankeetown and Madison requires about 4½ days.

Coal Pumper Quits

The Susquehanna River in northeastern Pennsylvania has been cleaned up and one coal mining company is about to go out of business. The firm of F. H. Downey, Inc., has operated a fleet of coal-dredging barges on the Susquehanna River for a long time. At one time there were 17 firms pumping fine coal from the river bottom. The use of settling basins in the coal fields along the upper Susquehanna and increased enforcement of stream regulations has cut to a trickle the amount of coal being carried downstream by the Susquehanna.

At the peak of their operations, the Downeys helped produce 1500 tons of fine coal daily for a local steel mill.

Manganese Search

The Blue Ridge Mountains of Virginia are presently being explored for manganese by the Ivanhoe Mining & Smelting Co. The search area is about 10 miles north of Buena Vista, Va.

About 1910, manganese was mined in the area. Since World War I, however, there has been no mining activity there.

BCR Meeting

Bituminous Coal Research, Inc., held its first Techno-Sales Conference and its annual meeting in Columbus, Ohio, March 23 and 24. BCR activities and opportunities were outlined to the large group in attendance and various projects now under study by the research organization were described. The bulk of the latter have to do with developments of greater markets for bituminous coal and its more efficient utilization in the markets industry now holds.

Steve Krickovic and Gerald von Stroh described the mining development program of BCR to the meeting. Krickovic discussed "Significance of Mining Research Projects and Opportunities." He described the status of the continuous mining machine which BCR developed (to be produced by the Le Roi Co.); the extensible shaker conveyor for continuous face transportation (now being further developed by Joy Mfg. Co.); face illumination; and roof bolting indicators. The progress of the group in continuous mining research was outlined by von Stroh.

A highpoint at the group's annual meeting was the naming of J. B. Morrow as the recipient of the second annual BCR award for "Outstanding Leadership on Behalf of Industry-Sponsored Coal Research." Dr. A. A. Potter, president of BCR, presented a bronze plaque to Mr. Morrow for his contributions to the bituminous coal industry.

MINIMUM SUPERVISION

Can Yield Optimum Efficiency In Your Coal Washing

With a minimum of operating attention, the SuperDuty Diagonal Deck Coal Washing Table easily excels in operation any other table or process in common use today in the preparation of fine coal sizes.

The combining of advantages inherent in the diagonal deck design with a smooth-running head motion and a balanced, factory aligned underconstruction, permits practically automatic operation without operational tinkering. Thus, with minimum attention, the SuperDuty yields large tonnages of "premium" production at almost unbelievable recovery figures.

Installations of up to 64 units are currently being supervised by one operating attendant. For full information send for Bulletin 119.

Concenco Feed Distributor

The Concenco Revolving Feed Distributor is a heavily fabricated all-steel machine with motor drive requiring 1 H.P. or less in operation. It effectively provides a splitting of feed into any desired number of equal portions, to accurately feed circuits of machines in battery for greater overall efficiency. Unexcelled for feeding coal washing tables.

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Asks For W. Va. Safety Meet

Frank B. King, chief of the West Virginia State Department of Mines, has called for the renewal of a statewide first aid meet in West Virginia. Annual statewide contests were discontinued during World War II and have not been started since. King made this bid for resumption of annual contests at a meeting of the Mid-State Coal Mining Institute near Richwood, W. Va., in late March.

Recover Wasted Coal

The Beaver Brook Coal Co., Beaver Brook, Pa., recently contracted to install a new 200-tph heavy media plant to recover anthracite from bank material discard at an old anthracite breaker. One hundrey fifty tph of 4-in. by 5/16-in. material will be treated in a Wemco Drum Separator. The expected recovery of clean anthracite is 20 percent of the feed to the plant.

Search For Florida Rutile

Several prominent companies have joined, without much fanfare, the search for mineral-bearing sands containing titanium and rutile in Florida. Several deposits in the State are now being worked and they may be augmented within the next year by other large scale operations. The growing need for titanium in the manufacture of jet engines seems to be the moving force behind this new activity.

The Crane Co., Chicago, which manufactures plumbing fixtures, has established headquarters in Panama City, Fla., and its geologists are making forays along the west coast of Florida. The company is reported to have taken leases on several thousand acres in that area with a view to determining the recovery value.

National Lead Co. has one of the oldest ilmenite operations in Florida. It is now carrying on operations close to Jacksonville.

The Du Pont Co. has for more than a year been working a deposit near Starke, Fla., and recently announced that it would proceed at once with a large mining and processing plant at Lawtey. Operations are being carried on by the Humphreys Gold Corp.

Still another operation is being carried on by the Florida Ore Processing Co. at Melbourne on the east coast. It has been engaged in processing mineral-bearing sands for some years.

Uranium Air Search

Another airborne radiometric survey for uranium ore is presently under way in the northern New Jersey and adjacent southeastern New York area. The air operations are being combined with ground reconnaissance and Safair Flying Service is doing the flying out of Teterboro, N. J., airport.

A 25-day survey of west central New Jersey and eastern Pennsylvania was completed March 11 without any significant discoveries of radioactivity. The entire area was surveyed with a scintillometer carried in the aircraft, and included territory stretching from Clinton, N. J., past Flemington and Lambertville, and westward to Doylestown, Pa. It was done from a plane flying 100 feet above the ground.

Lead Production Off 14 Percent

Domestic mine production of lead in 1953 was 335,000 tons, a 14 percent decrease below the 1952 mine output and 19 percent below the 1941-52 annual average. These figures have been released by the U. S. Bureau of Mines.

Missouri for the 46th consecutive year, was the principal lead-producing state, supplying 124,000 tons or 37 percent of the domestic mine output. Idaho and Utah were second and third, respectively, accounting for 21 and 12 percent of the nation's total. All 20 producing states except New York, Kentucky and Wisconsin reported reduced output during the year. Lead imports totaled about 560,000 tons.

Curtail Iron Operations

In early April, unsettled conditions in the iron and steel industries forced several iron mines in the Upper Peninsula of Michigan to curtail their weekly working schedule or close down.

Inland Steel Co. closed its Cayia iron ore mine after two months of suspended operations. Pickands Mather & Co. announced that it was operating its mines at Iron River and Crystal Falls on a four instead of a five-day week. At the same time, Cleveland-Cliffs Iron Co. cut operations at its iron mines on the Marquette range from five to four days a week.

In all, about 3400 employes were affected.

USBM Bibliography

A bibliography of Bureau of Mines Investigations of coal and its products from January 1, 1945 through January 1, 1950, has been released by secretary of the Interior Douglas McKay.

The bibliography lists Bureau papers on all phases of coal research, including those dealing with health and safety investigations and with coal-to-oil research, published during the years covered. Included also are articles contributed by Bureau personnel to scientific, technical and trade journals.

Material has been classified according to subjects, and papers within each subject classification are grouped on the basis of mediums of publication. Those within each group are arranged alphabetically by authors.

Bureau of Mines Bulletin 528, "Bibliography of Bureau of Mines Investigations of Coal and Its Products, 1945 to 1950," can be obtained only from the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C., for 40 cents a copy. This bulletin is not for sale by the Bureau of Mines.

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Drop Out of UMW

The Stearns Coal & Lumber Co. has resumed operation after 50 miners dropped their United Mine Workers membership and formed a new local group that has signed a two-year contract with the company. The mine near Stearns, Ky., had been shut down for nearly three months.

Pocahontas Operators Meet

The Pocahontas Operators Association held its Annual Meeting at the New Yorker Hotel, New York City, Friday, March 26.

Henry F. Warden, of McComas, W. Va., and New York City, was elected president, to succeed Wm. Beury. Warden is also president of the American Coal Co. of Allegany County and Wm. C. Atwater & Co.

The membership was reluctant to accept the decision of outgoing president, Wm. Beury, not to head up the Association again, and passed a resolution commending him for his excellent leadership and outstanding service during his four-year presidency. He is president of the Algoma Coal and Coke Co., Algoma, W. Va., and is held in high esteem not only in the Pocahontas Coal Field, but throughout the entire southern coal industry.

Roland C. Luther, executive vice-president, Peerless Coal & Coke Co., with offices in Bluefield and Vivian, W. Va., succeeds Warden as treasurer of the Association. Other officers included H. R. Hawthorne, vice-president, and B. B. Housman, secretary who was reelected. The Executive Committee, composed of Henry F. Warden, chairman, H. R. Hawthorne, Wm. Beury, Roland C. Luther, A. R. Matthews, J. J. Foster, W. W. Walker and Samuel A. Crozer, was reelected.

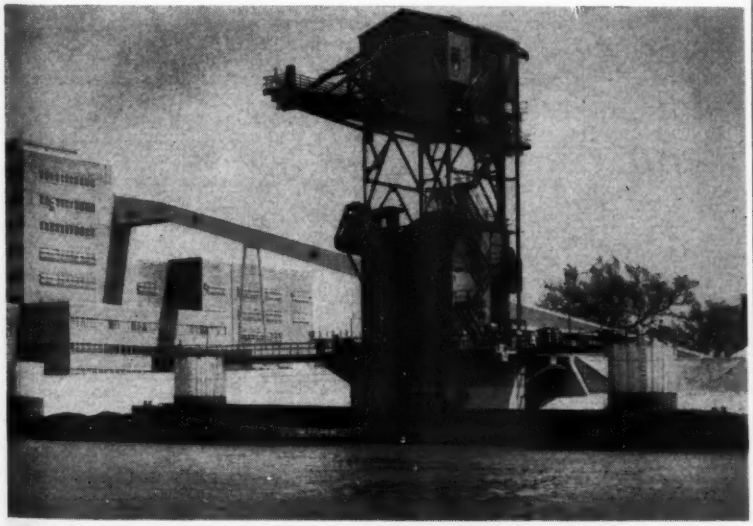
There were no changes made in the present representation on the boards of the various affiliated associations, nor on the committees within the Pocahontas Operators Association itself.

Nash Dome In Production

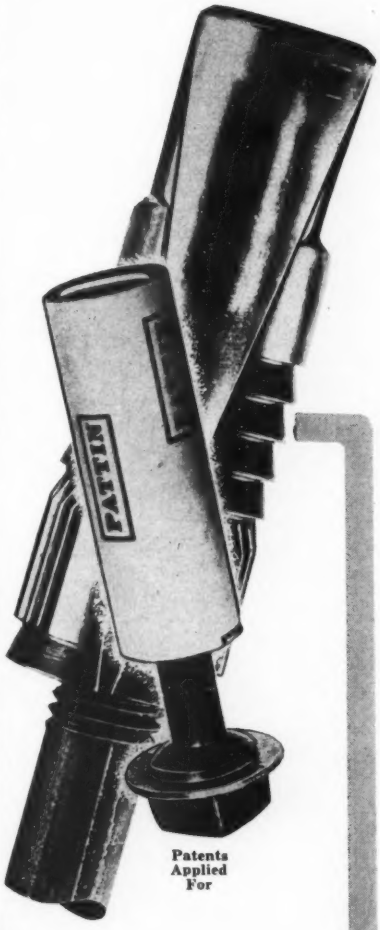
Freeport Sulphur Co. has announced that its new mine at Nash Dome, 35 miles southwest of Houston, Tex., has been placed in production. Nash Dome is one of four new sulphur projects the company has undertaken in the last several years and is the third to go into operation since November, 1952. The other three projects are in Louisiana.

Cite ARMCO Foremen

High honors have been accorded the Armco Mining Division Foremen's Club by the National Association of Foremen. The Armco Club is made up of mine supervisors in Raleigh and Boone Counties, West Virginia, and was organized in 1946. It was the first club of this nature in the coal industry and for the past four years has had a rating of "excellent club" by the National Association of Foremen. In 1953 greater recognition was received by the Armco club, when it was rated third in their geographical zone and fifth in the nation.



Virtually all coal used at the new Hennepin Power Station of the Illinois Power Co., 20 miles southwest of La Salle, Ill., is unloaded from river barges by this specially designed equipment constructed by Dravo Corp., Pittsburgh. Operating along a 100-ft runway supported by the tower, the rope-type trolley handles a 6½-ton clamshell bucket to dig coal from barges on the Illinois River. With a 35-second free-digging cycle, the unloader can deliver some 670 tph of coal. Average performance, including barge-shifting and cleanout, is 450 tph. One man controls the entire operation.



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Many time studies and tests made by roof bolting crews on expansion shell load-strength and bolt handling and installation time show that the new PATTIN double expansion shell assembled with bolts with the new self-centering head cut usual handling and installation time up to 30 per cent while providing the strongest known anchorage for the bolts. Have your bolting crews test the PATTIN shells and bolts. Write or phone us—we'll gladly work with you on any bolting tests.

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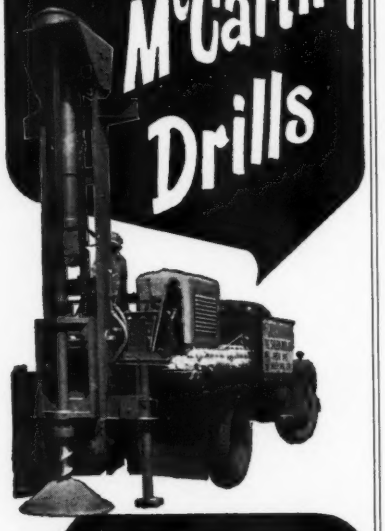
MINING OPERATORS USE McCarthy Drills



Heavy-Rugged-Powerful

AT Bessemer Limestone & Cement Co., Bessemer, Pa., one McCarthy unit (above) averages 90 ft. per hour, drilling through hard blue shale and sand rock 34 ft. deep. Blast holes are drilled on 18-ft. centers. Two men handle the whole job, including setup and moving. McCarthy drills operate with gasoline, diesel or electric power units . . . on all types of mounts. McCarthy "money-savers" can work for you. See your nearby distributor or write Salem Tool direct for further information.

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Westmoreland Coal 100 Yrs Old

The Westmoreland Coal Co. is celebrating its 100th Anniversary this year. Chartered on July 7, 1854, Westmoreland Coal Co. that year opened its first mine, the Lorimer mine, in Westmoreland County, Pa. In 1856 the company bought two more mines and expanded productive capacity to 112,000 tons. In 1870 it absorbed the Foster Coal and Iron Co. and a year later absorbed the Westmoreland-Youghiogheny Coal Co.

Expansion continued and in 1874 the company took over the Philadelphia and Youghiogheny Coal Co., and in 1880 it added the Shafer Coal Co. to its holdings. The Westmoreland Coal Co. absorbed two more companies in 1918—the Penn Gas Coal Co. and the Manner Gas Coal Co.

During the century of operation, Westmoreland Coal Co. has produced 166,530,683 tons of coal. It has averaged 1,665,307 tons a year, the peak year being 1913, when 4,794,835 tons were mined.

Upgrade Southern Iron Ore

National Lead Co. and Republic Steel Corp. have announced a joint project to upgrade southern iron ore and iron-bearing materials.

The project could be of great importance to the entire iron and steel industry. Its success would result not only in the upgrading of ore now usable, but also in the utilization of mineral resources which are now of little economic value and have heretofore not been usable by the steel industry.

A large scale pilot plant is now under construction at Republic's Spaulding iron ore mine near Birmingham, Ala., where production scale studies of the contemplated upgrading project will be made. The pilot plant will be completed and in operation this summer. The iron ore concentrate to be produced is expected to be sufficiently upgraded to warrant its use in modern blast furnaces.

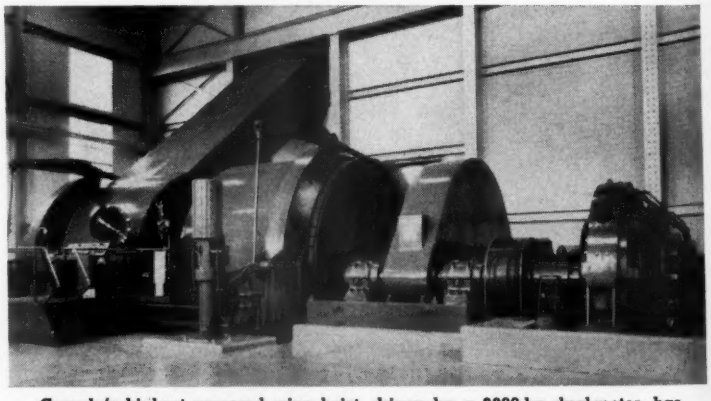
The joint project combines the broad experience of both companies in closely related fields. The extensive experience of National Lead in the treatment of non-ferrous ores supplemented by its extensive research in Norway during the past eight years is matched by Republic's experience with southern iron ore as well as in the beneficiation and use of low iron content southern non-magnetic materials.

Foote Mineral Expansion

The directors of Foote Mineral Co. have tentatively approved further expansion of facilities for the production of lithium ores and chemicals, H. C. Meyer, chairman of the board, recently announced. The proposed expansion, which has been under study for almost a year, will include major additions at the company's Kings Mountain, N. C., and Sunbright, Va., plants. Facilities at the Exton, Pa., plant will be increased to a lesser extent. Many of the present facilities were designed and built in the expectation of further expansion.

Meyer said that the probable cost of the proposed expansion will amount to several million dollars. The company expects to finance the cost of the new facilities through bank loans and does not contemplate any public financing at this time.

Install 6000-Hp Hoist



Canada's highest powered mine hoist, driven by a 6000-hp dual-motor, has been put into operation at one of the new shafts at Frood-Stobie Mine of The International Nickel Co. of Canada, Ltd., at Copper Cliff, Ont. Controlled by push button from an operating station underground, the hoist will lift skips, each containing 15 tons of nickel-copper ore, at an average rate of 14,000 tpd. Installed in conjunction with the new hoist are bottom-dump skips. Kimberly type skips have been standard in Inco operations up to now. Maximum speed of the hoist will be 3000 fpm.

Dust Prevention

(Continued from page 56)

and for preservation of the bond of the stabilized wearing course, that blading is done only if the road surface needs it. And then, only when the surface is damp.

Typical annual maintenance might be outlined as follows:

(1) *Early spring*—Shaping of road with patrol grader to adequate crown and smoothness and then application of one lb per sq yd surface treatment.

(2) *Summer*—Normally no blading is required; however, if roughness occurs, the blading should be done immediately following a rain. Blade only a road section of such length that will be readily compacted before the surface becomes too dry to bond under traffic.

Applications of ½ lb per sq yd should be applied as needed. These applications should be made just before ravelling or dusting appears. Normally two applications per year are necessary.

(3) *Fall and Winter*—Two to three bladings are usually required to keep the road in proper shape during winter months.

The road construction methods outlined above are the result of 30 years' laboratory and field experience by Highway Departments the country over. It is true that these people did not have to contend with the loads found in the mining industry's open pit and strip mines. But calcium chloride treated roads have done yeoman's service on heavy construction projects such as dam building for the Tennessee Valley Authority and in Army Training camps where tank traffic had created dust problems before the use of calcium chloride.

Because it is a chemical, one might wonder about calcium chloride's corrosive properties. However, there is nothing to worry about on this score. Calcium chloride does not attack metal. It attracts and holds moisture to a surface, therefore, equipment used in spreading should be rinsed with water after each use; however, it is not any more corrosive than water alone.

Construction and maintenance of calcium chloride treated roads are simple operations. There are only three major points to strive for:

(1) A compactible gradation of road material;

(2) A proper crown on the road, and;

(3) the presence of moisture before the application of calcium chloride.

Technical service engineers of the calcium chloride industry are available to assist in planning a haulage road program and a request addressed to the Calcium Chloride Institute, Ring Building, Washington, D. C., will secure engineering assistance in your dust preventive program.

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Tri-Rod — For knife-like separations.

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Full week operation depends upon the *salability* of your product . . . and Bee-Zee screen shapes and designs, engineered to specific applications, help you produce the *best* product for your market! *Accurate* sizing for *always dependable* uniformity . . . *sure* separation for *constant maximum* in Btu content—you get the ultimate in preparation with Bee-Zee screens. They *make you money!*

All Bee-Zee screens are precision spot-welded of stainless steel. Supporting rods can be spaced for best performance.

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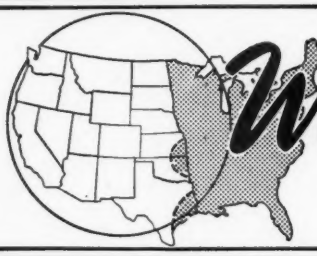

Western States

Grant For Lignite Research

A grant of $3400 for research on lignite was awarded to the University of North Dakota College of Engineering, according to Dean E. L. Lium. The grant, for one year of basic research, was made by the National Science Foundation in Washington, D. C. It is for "absorption of water vapor at different relative humidities by thermally treated lignite". W. R. Kube, assistant professor of chemical engineering, University of North Dakota, is in charge of the project.

The study will seek to measure the rate at which lignite is converted to coal as temperature increases. The rate of moisture pickup of dried lignite will be studied to determine where practical drying ends.

Central Eureka Closes

The Central Eureka mine, one of California's largest remaining gold mines, is being shut down. Company officials said they would let the mine, located at Sutter Creek, Calif., fill with water and will liquidate its equipment and surface buildings.

In its 102-year history, the Central Eureka mine has produced more than $76,000,000 worth of gold. The mine has operated fitfully since the war, but operations have been suspended for the past five months.

Taylor-Knapp Activity

The Taylor-Knapp Co. reports that it has initiated operations in its long planned project for deeper exploration near Philipsburg, Mont. This program will require two or three years for completion. It is planned to dewater the 1000-ft True Fissure shaft to the 900-ft level, 300 ft below the deepest development now existing.

Records indicate the True Fissure shaft had a station cut at the 900-ft level by the Philipsburg Mining Co. in 1920, but no further development was done at that time. Intermittent mining operations were carried on by leasers with the water level at about the 400-ft level until 1949 when the shaft was dewatered to 500 ft. Early in 1951 the pump was lowered and the mine dewatered to the 600-ft level.

Manganese ore is upgraded in the company mill and delivered to the General Services Administration depot in Philipsburg at the rate of 500 to 800 tons per month.

To handle moderately heavy flows of water expected from the 9000 lin ft of proposed exploratory workings on the 900-ft level, a 450-hp submersible pump will be installed and other additions and modifications of the mine and mill are planned. The new pump will handle 1500 gpm of water. Also included in the new project is deeper exploration of the Durango mine in an area 2000 ft west of the True Fissure shaft.

Fight Claim Jumpers

Uranium prospectors in the Moab, Utah, area have banded together to protect their mining claims against claim jumpers. The Utah Uranium Miners Protective Association, according to a spokesman, is keeping Utah's uranium prospecting "clean, fair and healthy."

Kennecott Cuts Production

Kennecott Copper Corp. has cut copper output at its properties in Nevada, Utah, Arizona and New Mexico.

On March 7, the Ray Mines Division of the corporation went to a five day week with operations suspended Saturdays and Sundays. On March 8, the Chino Mines Division also went on a five day week and on March 15 the Nevada Mines Division and the Utah Copper Division of the company announced that they too were going on a five day week, suspending operations on Saturdays and Sundays.

Reduction in work schedules follows by about a month an earlier cutback at the Ray Mines and the Chino Mines Divisions. These earlier cutbacks did not result in the laying off of any men. However, the new curtailments will idle about 1169 men: 170 at the Nevada Mines Division; 644 at the Utah Copper Division; 55 at the Ray Mines Division, and 300 at the Chino Mines Division of the company.

It has been estimated that all cutbacks announced to date by the corporation will mean an over-all reduction of about 25 percent in its production of refined copper.

Vindicator Shaft Work

Work at the Vindicator Silver-Lead Mining Co. property, east of Mullan, Idaho, has been placed on a three-shift basis, according to Gale Hansen, superintendent. A dump trestle has been rebuilt and a 75-hp hoist has been reconditioned. It is to be moved underground to the raise.

Work done earlier consisted of rehabilitating an adit to the shaft site and placing surface equipment in shape. Objective of the undertaking is to do deep level exploration of the Vindicator vein on the 400 and 800-ft levels.

A. E. C. Needs Geologists

The U. S. Atomic Energy Commission needs experienced geologists in its Division of Raw Materials in domestic positions in Grand Junction, Colorado. Salaries—$4,060 (GS-9), $5,940 (GS-11) and $7,040 (GS-12) depending on experience. Minimum experience three years, some graduate work preferred. Civil Service status not required. Those interested should write to U. S. Atomic Energy Commission, Grand Junction Operations Office, P. O. Box 270, Grand Junction, Colorado, Attention: Mr. E. R. Gordon, Director, Exploration Division.

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Open Up That Golden Gate

All Indications Point to an Outstanding Convention and Exposition for the Nation's Metal and Nonmetallic Miners

SEPTEMBER 20 through September 24, 1954! These dates mark the period during which the American Mining Congress will hold the 1954 Metal and Nonmetallic Mining Convention and Exposition in San Francisco's Civic Auditorium.

Ever since the appointment of the National Program Committee headed by Frank Milliken, vice-president, Kennecott Copper Corp., suggestions for convention papers have been rolling in to the Washington office. When the State and District Chairmen of the Program Committee meet in San Francisco next month, they will carefully review this cross section of the industry's thinking, and formulate a program calculated to help solve the industry's most important problems—operating, economic and political.

Top executives of mining companies; superintendents of mines, quarries, mills and smelters; engineers, shift bosses, electricians, mechanics, machine operators, drill runners—every man on the job will be able to turn in a better day's work for the effort he puts in when he practices the lessons learned at the convention sessions. Of equal value will be the knowledge and familiarity with the newest equipment gained through careful inspection of the hundreds of exhibits in the show. Not only will each visitor be able to see the newest in mining equipment and supplies, but he will be able to discuss his operating problems at first hand with the manufacturers' technical staffs.

With more than 140 manufacturers and suppliers to the mineral industry participating, the exposition has already spread out from the San Francisco Civic Auditorium to a 40,000-sq ft area on Grove Street that will be specially enclosed for the purpose. Every conceivable kind of surface and underground mining machinery together with milling and metallurgical equipment of all types will be on display, indoors and out.

While the plans for field trips have not yet been finalized, following the business of the convention and the exposition, there will be an all-day Salmon Derby and a trip to the gold dredging fields of the Sacramento Valley.

On Friday, September 24, also, arrangements have been made for the fall meeting of the Mineral Beneficiation Division of the AIME. This will enable those interested in ore benficiation problems to attend the milling sessions at the American Mining Congress meeting, see all the new equipment in the exposition and attend the fall meeting of the MBD, all in one trip.

Be sure to make plans now to attend this greatest AMC Metal and Nonmetallic Mining Convention and Exposition. Thousands of other mining men will be there, so it is advisable to make reservations early.

Those who have not yet received hotel reservation blanks should request them from the American Mining Congress, Ring Building, Washington 6, D. C., or communicate directly with the Housing Bureau of the San Francisco Convention and Visitors Bureau, Room 300, 61 Grove St., San Francisco 2, California.

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Shannon Mine Bought

Illinois Zinc Co. has agreed to purchase the Shannon Mine at Gleeson, Ariz. When title to the mine is gained, the company plans to rehabilitate the property and its two shafts. One shaft is down 600 ft and the other 400 ft.

The Shannon Mine was originally a copper producer but also contains lead and zinc ores. It was operated from 1896 to 1919. Since then it has been operated intermittently by a number of small lessees.

Illinois Zinc estimates it will take at least 60 days from the time of complete acquisition before mining can be started.

Uranium Found in Alaska

One uranium claim has been staked in the Brooks Mountain range on Alaska's Seward Peninsula. Two uranium strikes were reported early in March, according to Territorial Mines Commissioner Philip Holdsworth. The two strikes were made last fall at widely separated points. Holdsworth cautioned against making any premature claims for the richness of the deposits as it is not known whether uranium ore exists in commercial quantities.

Pend Oreille Expands

Pend Oreille Mines and Metals Co. will soon complete the expansion program at its mill in the Metaline district of northeastern Washington. Installation of the third 800-ton unit in the company's east milling plant is just about finished. This will complete original plans for a 2400-ton capacity in the new flotation facility. The first unit was installed in 1950 and was put into operation in January, 1951. The second unit went on the line in August, 1952. Last year the two units operated to capacity as the company stepped up production 40 percent.

Mechanization of mining operations has proved to be the answer to low metal prices, according to Loren G. Billings, mine superintendent. He recently told a meeting of the Columbia section of the AIME that trackless mining is now employed for about 90 percent of the mining operations. General manager W. L. Zeigler has said that mechanized methods have increased output per man shift of the underground crew from seven to 16 tons.

Wyo. Carbonization Tests

The Kemmerer Coal Co. is conducting experiments in high temperature coal carbonization at Kemmerer, Wyo.

The coal company established in 1897, operates both a strip mine and an underground mine in the Kemmerer Field. Three seams of high grade coal are mined to supply raw material for the carbonization research and coal for the market. The Kemmerer Coal Co. is the only company in the west carrying on this type of research, according to its president, Glenn Sorenson.

Choose MMSW in NLRB Poll

Workers at two Montana plants of the Anaconda Copper Mining Co. recently voted two to one to maintain the Mine, Mill and Smelter Workers International Union as their representative. The plants, in Butte and Anaconda, employ a total of nearly 8,000 men. The National Labor Relations Board election was to determine whether Mine-Mill was to continue as the workers' union or the CIO, United Steelworkers, was to become the new bargaining agent for Anaconda employes. The official count was 4,099 for Mine-Mill to 2,185 for the CIO.

In recent months the CIO union has won bargaining rights in some 15 other plants from Mine-Mill leadership, which is accused of Communist domination.

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Sulphur Plant

Jefferson Lake Sulphur Co., has broken ground for a plant at Manderson, Wyo., to recover sulphur from sour gas. Initial production of about 150 tpd will later go to 300-400 tpd. Ralph Parsons and Co., Los Angeles is contractor.

Find New Mineral

A new vanadium mineral previously unknown to science has been found in the Monument No. 2 mine in northeastern Arizona, acording to the U. S. Geological Survey. The mineral, described as a "dark brown, fibrous mineral composed of hydrated vanadium oxide" has been named Navajoite in honor of the Navajo Indians on whose reservation the mine is located.

Sidney Leases Workings

Sidney Mining Co. of Kellogg, Idaho, has leased upper working of its mine to employes. All workings of the Pine Creek District mine above the 900 haulage level have been leased under an incentive block-leasing plan. The company is continuing small stoping operations on the 1100-1300 levels and exploration work on the new 1500 level. It is also sinking to the 1700 level.

Alkaline Leaching

(Continued from page 52)

varied from 10 minutes to several hours at the discretion of the operator; no impurities are introduced in the solution which is thus admirably suited for use in a subsequent leaching operation.

In general, the leaching times are reasonable, uranium recoveries of 92–99 percent are obtained, temperatures and pressures are such that the leach can be carried out in a continuously operating autoclave, compressed air requirement is small, reagent consumption is low and is largely dependent on the amount of sulphide in the ore, impurities normally present in the solution do not materially affect the leaching rates or recoveries.

The hydrogen precipitation can be carried out readily and rapidly at moderate temperatures and pressures —the precipitation is complete: the barren solution can be recycled to the leach, and a high-grade product is obtained.

Most of the equipment can be made of mild steel as the carbonate solution is not corrosive; heat can be conserved by the use of heat exchangers and proper insulation; all operations can be made continuous and can be controlled by automatic devices.

Photographs courtesy Sherrit-Gordon. Flow sheets (pages 50-51) courtesy CIMM and AIME.

On top—or underground

It's familiar territory to the Copco men

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Boulder, Colorado

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Our accident rate is down, now that we're using roof bolts

"Since we replaced the old-style roof supports with steel roof bolts, the accident rate at this mine has dropped considerably. Not only that, working conditions are better, too."

Roof bolting reduces the possibility of mine accidents because the bolts act as "sky hooks." They consolidate several layers of strata into a thick beam, and hold them together as a single unit. In addition to affording greater protection to workers, roof bolting also makes possible wider clearances, increased room in which to operate mechanized equipment, and improved ventilation.

To enable operators to obtain these conditions, Bethlehem manufactures two types of roof bolts for use with expansion shells; also a slotted bolt for use with a steel wedge. All three types come in lengths of from 2 ft to 8 ft.

SQUARE HEAD BOLTS

⅝-in. Diameter. A square-head, high-strength bolt, having the same physical characteristics as the Bethlehem ¾-in. bolt. Designed for 1⅜-in. hole. Can also be used in 1-5/16 in. hole. Comes without ears, and is recommended for use with uniformly-expanding Type "F" shell. The shell, consisting of two pieces held in place by a wire spring, has maximum expansion of 1⅞ in.

¾-in. Diameter. This ¾-in. square-head bolt is for use in a 1⅜-in. hole. Has rolled threads and an unchamfered head. Used with Type "C" shell. Pressed ears on bolt shank support shell during anchoring. When bolt is tightened, the leaves of shell expand in the hole. Bolt is also suitable for Type "F" shell.

SLOTTED BOLT

A 1-in. bolt with centered, forged slot. No metal removed during slotting. Other end of bolt has 5 in. of 1-in. rolled threads. When driven in 1¼-in. hole, wedge drives deep into slot when back of hole is reached, expanding end of bolt. Truncated-cone point prevents damage to threads. Fitted with American Standard Regular Square Nut.

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BETHLEHEM STEEL

BETHLEHEM MINE ROOF BOLTS

Recent Drilling Trends

(Continued from page 28)

ance and possibilities for further improvements are in sight. Intraset steel with chisel bit was used in drifts with good miner acceptance, but costs per foot were high. Rods broke in the heat treat zone, with only half the bit worn. As stated before, the drift miners sharpened their own steel to avoid transportation, consequently, the bits were not kept in the proper condition.

Results of Bit Tests

Tests have been run on bits. One-use steel bits, tungsten carbide detachable and tungsten carbide intraset bits have been tested. The results thus far are as follows: (1) One-use steel bits yield favorable costs but the miner acceptance and performance have been low. Consequently, the cost per ton has been higher. (2) The chisel tungsten carbide bit integral with the rod has had good miner acceptance, but showed high costs per foot due to the rod breaking before half the tungsten carbide insert is worn. It is also hard to justify handling the intraset rods, since sharpening bits on the job is not practical. (3) Tungsten carbide detachable bits yield the most favorable costs and have increased the miners' performance.

Difficulty with the thread connection was encountered at the beginning of the test, but as miners improve their operating technique and as the shop improves its rod fabrication, the problem diminishes. Down-stroke rotation is being considered as the possible solution to thread troubles. One mine with below average bit footage has been able to double its bit life by switching the down-stroke rotation. Another mine is having a good deal of thread trouble, and indications are that down stroke will improve the situation. Other mines appear to be doing well on upstroke. A slight increase in maintenance costs and a slight decrease in penetration rate have resulted from the switch to down-stroke rotation. Tungsten carbide bits now in use are inspected at a central shop daily and all bits are accounted for. A careful record is kept on all bits so that an exact cost per foot can be obtained. Because our rock is relatively unabrasive, gauge loss with tungsten carbide bit has been practically nil. This prompted going to smaller holes and smaller powder of the same strength, with the gratifying result of decreasing powder costs by 20 percent.

In comparing the four-point bit with the chisel bit, it is found that the four-point drills a much straighter hole, and makes for quicker and easier collaring of holes. As to steel section, the hexagonal is favored over quarter octagon because it allows freer rotation in our smaller holes.

To us, the foregoing represents progress, but, from every indication, further progress may be expected. During the short period of our testing, numerous modifications in design have come through. Many more can be expected. A telescopic leg has recently come out which, so far, is doing a good job at Calumet. We would welcome a new and better bit connection and see no reason not to expect it eventually. The quality of alloy steel has been improving, and should continue to do so. Our own blacksmiths have, with the help of service specialists, improved their technique and improved rod quality greatly. The outlook for future improvement is excellent.

To Increase Manganese Output

Haile Mines, Inc., expects to increase production of manganese nodules at its Lake Valley manganese property at Lake Valley, N. M. Manganese, Inc., a partly owned subsidiary, put its new flotation plant into operation late in January. It is expected that production will be steadily increased, as various departments are brought up to capacity, with a goal of something over 100,000 tons per year of nodules being the target.

A development program at the Hamme Mine of the Tungsten Mining Corp., another partially owned subsidiary of Haile Mines, Inc., has been completed. Both shafts are below the 1500-ft level with ore pockets and stations prepared. Crosscuts at the 900-ft level are completed and drifting on the veins at this level has begun. Ore has been encountered by drill holes at the 1500-ft level in both shafts and will be developed to that depth as required. All mining to date is still from the 700-ft level and above.

Fire Hits Colorado Coal Mine

A blaze severely damaged the Hi-Way coal mine near Lafayette, Colo., early in March. The mine tipple caught fire early in the morning and flames spread to the mine shaft. Officials indicated plans for future operations will depend on the extent of damage.

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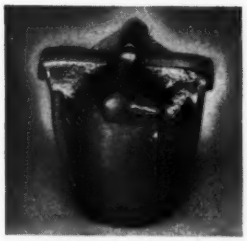

Carbide Rok-Bits make and break footage records. This Rok-Bit drilled 11,182 feet of Penna. iron ore. Exceptional? Perhaps! Why not test them in your operation.

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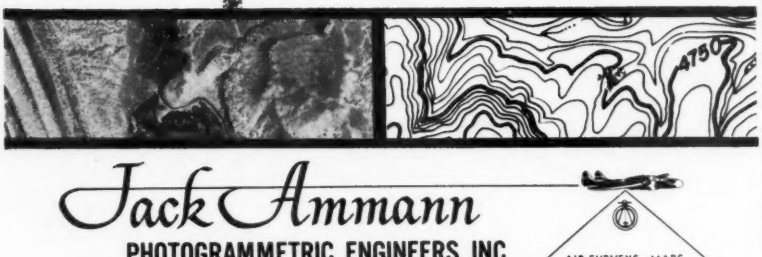

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To Build Cement Plant

The California Portland Cement Co. of Los Angeles has announced plans for the construction of a cement plant in Kern County, Calif. The cement company now operates a 5,000,000-bbl capacity plant at Colton, Calif.

Cleveland Mine Reopened

The Cleveland mine, located in Jefferson County, Mont., is now being leased by Harold Longmaid and John Hopkins, who are shipping lead-silver ore to the East Helena smelter of American Smelting & Refining Co. This is the first time that the Cleveland has been operated in the last 47 years, it is reported.

Ready For New Shaft

Nevada Rawhide Mining Co. is ready to contract sinking of another shaft to 200 ft at its mine 30 miles south of Fallon, Nev., according to reports. The No. 1 shaft now is down 70 ft and silver-lead ore is being shipped.

Three-Year Ore Hunt Ends

The Sierra Uranium Mining Co., which will make its headquarters at Truth or Consequences, N. M., recently leased the uranium mining claims of Jack Chatfield in the Worden Mountains, 25 miles south of Truth or Consequences. Under government regulation the company is now limited to mining and shipping the ore, but hopes to prove to the AEC that there is sufficient ore present to justify the construction of a mill.

Mining at the claims brings a three-year hunt to a climax for Jack Chatfield—who originally discovered the uranium. Chatfield began his search for the uranium in 1950 when a friend gave him a geiger counter.

To Ask 25-Cent Wage Hike

Mine, Mill & Smelter Workers officers announced at the end of a three-day conference in early April that the union will demand a 25-cent-an-hour increase in the non-ferrous metals industry.

Other demands outlined by the union were: (1) One week's severance pay for each year of service to employes laid off or discharged. (2) A national occupational disease fund financed by employers. (3) A general improvement in health, welfare and pension plans. (4) Premium pay for Saturdays and Sundays. (5) Fair employment practices and safety clauses in all contracts.

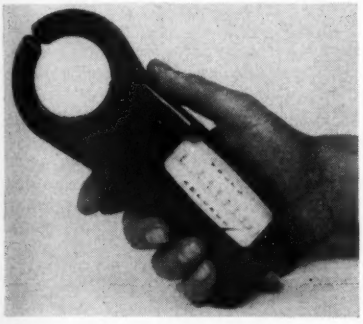
The 150 delegates to the wage and policy conference reaffirmed the international union's policy of "struggling for the six-hour day with eight hours' pay."

Manufacturers Forum

Hook-On Volt-Ammeter

A new hook-on volt-ammeter believed to be the first with automatic scale changing has been announced by the General Electric Co.'s Meter and Instrument Department.

Designated the AK-5, the pocket-size unit is designed to measure current and voltage quickly and accurately. Its automatic scale changing



feature entirely eliminates the possibility of reading the wrong scale for the application, according to company engineers. It has a current range of 5/20/80/350 amp.

The instrument also measures ac voltage in three ranges (150/300/750) without auxiliary equipment, provides accuracy up to 3 per cent of full scale, and withstands a voltage breakdown test of 4000 v., ac.

Tap Connector

A new tap connector has been announced by Ideal Industries, Inc., 1963 Park Ave., Sycamore, Ill.

Among the advantages claimed for the new connector is greater holding pressure provided by a hex set screw which can be tightened with a wrench. An extra large pad and stirrup distribute the pressure over the entire connection area, reducing deformation of the wire and making a low-resistance connection. As a positive check on the connection, the electrician can see the joint through the sides of the connector as it is being made.

Because of the wide capacity range of each size, the tap connector is an all-in-one unit. Three sizes handle a range of combinations that formerly required as many as seven sizes of ordinary connectors. According to the manufacturer, this feature will make the connector easier to stock and electrical men will be able to do more jobs with fewer sizes.

Easy Communications

A new battery-operated FM radio unit with weight trimmed down to eight lb has been announced. Called the "Minipak" the unit has a two-channel transmitter-receiver. A removable whip antenna folds up into the carrying case, which is supplied. Complete information may be obtained by writing Radio Specialty Mfg. Co., Portland 14, Ore.

Timber Faster

A new high speed mine timber jack, said to be two times faster than conventional screw types, has been developed for safer, more economical timbering in mines. Faster operation is credited to a crank and bevel-gear arrangement which rotates the screw. The jack is said to have all of the safety advantages of a screw jack without the speed disadvantage.

Rotating heads permit the jack to be used flush against a wall or rib.

A variety of heads are available to accommodate all types of timbers.

With a capacity of six tons, the jack is available in five models with minimum heights from 3½ ft and maximum heights to 9½ ft.

Full information is available from the manufacturer, Templeton, Kenly and Co., Broadview, Ill.

Improve Drilling Performance

Reich Brothers Mfg. Co., Terre Haute, Ind., have introduced their Model 600 heavy rotary truck mounted blast-hole drill, using air circulation to evacuate drill cuttings. In addition, the unit can be equipped with a mud pump for drilling to depths of 3000 ft.

According to the manufacturers,

20,000-lb down pressure can be exerted on the bit and holes up to 6¼ in. in diameter can be drilled in hard rock and up to 7⅞ in. in diameter in soft rock. The unit weighs from 32,000 to 40,000 lb depending on power equipment. Hydraulic controls are used throughout.

The drill is equipped with a jib frame for easy handling of drill stems which come in 10-ft lengths. Hydraulic leveling jacks, operated from the main hydraulic system, permit vertical drilling in rough terrain. Dust from around the hole is removed by a dust collection blower and carried safely off through a six-in. hose.

Protect Cat Pump Housing

A new, two section, pump guard for the front mounted Cat No. 41 Hydraulic Control has been released by Caterpillar Tractor Co., Peoria, Ill., for use on the Cat D2 Tractor.

The guard gives both front and top protection to the pump housing—particularly useful on tractors equipped with front end loaders. It prevents trash from packing between pump housing and radiator.

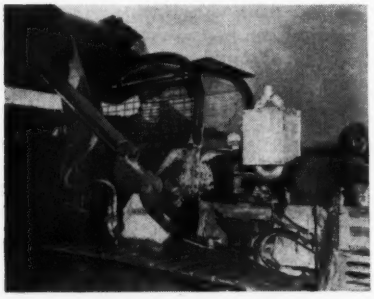
Operate Diesel Safely Underground

With the aid of a new catalytic device to eliminate exhaust fumes, the Coplay Cement Mfg. Co. has demonstrated that standard diesel equipment can be operated safely underground.

The Coplay, Pa., cement manufacturer has been using an above ground diesel-powered tractor-shovel in the underground workings of its limestone mine without any complaints from or ill effects to its 16 miners.

Coplay equipped its tractor-shovel —an International Lodover—with a new catalytic exhaust, called the Dieseler.

The device, specially designed for 4-cycle diesel engine operation by Oxy-



Catalyst, Inc., Wayne, Pa., oxidizes the irritating hydrocarbons and noxious carbon monoxide in diesel exhaust to carbon dioxide and water vapor.

Coplay reports that, even with continuous operation of its tractor-shovel, carbon monoxide concentrations in the exhaust have been consistently below 0.003 percent—well under the Bureau of Mines allowable maximum of 0.01 percent for an eight-hour exposure. Samples were taken with a Mine Safety Appliances squeeze-bulb indicator.

The Lodover is a 4-cycle, 62½-hp diesel unit that Coplay had previously been operating outdoors in its open quarry. Now the tractor-shovel is also used underground to load blasted limestone ore into shuttle cars for removal from the mine.

Rock Breaker

A new concept for impact breaking of stone and minerals has been introduced by the Contractor and Construction Equipment Div. of Kennedy-Van Saun Mfg. & Eng. Corp. of Danville, Pa.

Called the Kennedy "Cuber Senior," the unit is a dual rotor, up-running impact breaker designed for both stationary and portable use in open or closed circuit operation.

Two rotors with integral hammers provide the entire rock breaking action. According to the maker the reduction chamber is large enough to permit free breaking of infed rock without restricting flow or jamming the breaking area.

The unit will handle any quarry rock freely passing the 36-in. by 48-in. feed opening and, in many types of rock, can be operated in a closed circuit to produce 100 percent passing one in.

Write the company for complete information.

Problems Solved

Mathematical Computing Service, 105 Court St., Brooklyn 2, N. Y., specializes in performing services for industries desiring engineering calculations of a high degree of complexity, charts and nomographs, and the treatment of related mathematical problems in the field of mining engineering. An important function of the group is the mathematical formulation and complete solution of a problem from given physical data. The staff consists of consultants holding doctorate degrees who are qualified to treat problems in applied mathematics related to the physical sciences.

Announce New Electric Truck

An electric fork truck which will operate in a seven-ft aisle and can pick up and deposit loads without straddling pallets or skids has been developed by The Yale & Towne Mfg. Co., Philadelphia.

The new truck has 2000-lb capacity at 24-in. load center. Capable of extremely short radius turns, it can reach out and pick up or deposit a load at any height from floor level to 126 in.

The truck is also equipped with a deadman control which automatically cuts off power and applies the brake when the operator leaves the truck for any reason.

Protect Against Tramp Iron

The Electro-Manganese Corp., Knoxville, Tenn., has eliminated recurrent tramp iron damage to its Allis-Chalmers crusher by installing an Eriez permanent magnetic pulley as the head pulley on a belt conveyor handling manganese ore.

According to A. R. Godsey, plant engineer, the magnetic pulley is removing approximately 30 lb of tramp iron per week which formerly was the cause of machinery damage and resulting shutdowns for repairs.

The Eriez non-electric magnetic pulley is a product of Eriez Mfg. Co., Erie, Pa. Designed to maintain a magnetic field of constant strength across the entire face of the pulley, the unit's magnetic elements exert their force through the belt to hold all tramp iron securely to the belt while non-ferrous material, on reaching the pulley, falls clear.

P&H Introduces Improved Diesels

Announcement is made by Frank Edwards, general manager, P&H Diesel Engine Division, that Harnischfeger Corp. is now in production with a complete improved line of two-cycle diesel engines featuring 36 percent greater power output.

Most important change is the improved cylinder assembly. More effective and complete scavenging, achieved by a new valving arrangement and redesigned porting which imparts greater turbulence, is claimed. Horsepower ratings for the new models at 1800 rpm range from 58 to 255.

Complete information and specifications are available by writing the P&H Diesel Engine Division, Harnischfeger Corporation, Crystal Lake, Ill.

Self-contained Blasting Machine

Maximum safety and reliable performance for the user of industrial explosives are claimed for a new portable blasting machine of the condenser discharge type which is generator operated. It is believed to be the first condenser discharge type blasting machine utilizing a high voltage dc generator directly connected to charge the condensers.

The new machine is completely self-contained. A specially wound, permanent magnet dc generator is hand-cranked through a train of gears which permits cranking speeds to re-

main moderate. To prevent firing before the condenser is fully charged, an accurate relay is wired into the firing circuit.

Although the actuating button can be depressed while the operator is building up the charge in the condensers, the firing circuit cannot be closed (and the explosive fired) until the condensers are delivering a full 450 v to the relay.

The machine weighs 30 lb and measures 12½ in. high, 6½ in. wide and 9⅝ in. deep. It has been developed by Fidelity Instrument Corp. of York, Pa., with the cooperation of engineers of Atlas Powder Co. of Wilmington, Del., which has added the machine to its line of explosives, blasting supplies and accessories.

Bit For Roof Bolt Holes

A new cemented carbide-tipped prong-type roof bolting bit for drilling starter holes in coal, metal, and nonmetalic mines has been developed by Carboloy Department of General Electric Co., Detroit.

Designated the APT-24, the new drill bit was designed for fast, straight hole-cutting in shale and strata softer than sandstone. It also may be used to cut 1½-in. expansion anchor holes. The new tool has a standard ½-in. square shank, of heat-treated alloy steel.

Pressed Splices in Wire Rope

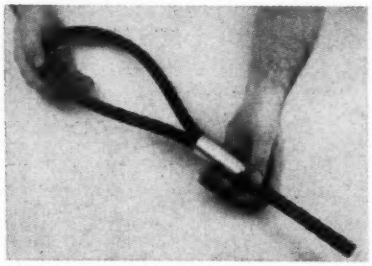
Savings in time are made possible by a new wire rope pressing system that eliminates hand splicing, according to J&L Steel Corp.

The new pressing system, announced by Jones & Laughlin Steel Corp., employs an aluminum alloy clamp or sleeve that is squeezed around the wire rope in a special 300-ton hydraulic press. Called JalKlamp, the device is used as a mechanical method of splicing eyes, with or without thimbles, in the ends of wire rope. This "splice" reportedly gives 100 percent of the breaking strength of the wire rope itself.

The clamp or sleeve in the new system consists of a piece of metal tubing that looks like a heavy bracelet, oval in cross section, with a place for the two ends of the wire rope cable to be clamped together.

To make a splice, the wire rope is first measured, cut and inserted in the clamp. Then the clamp is crimped or squeezed around the wire, the clamp metal flowing into the space between strand wires.

Jones & Laughlin is leasing special



300-ton capacity motor-operated hydraulic presses to apply this type of terminal to wire rope up to and including ¾ in. in diameter. Jones & Laughlin is the exclusive distributor of the clamps and presses in the United States. The clamps are made in Sweden under patents held by Gerhard Rohland of Goteburg, Sweden. The dies and special hydraulic presses are also of Swedish origin.

— *Announcements* —

Aeroquip Corp., Jackson, Mich., has announced the promotion of **Marvin W. Brandau** from industrial sales manager to director of market development.

J. Joseph Kelleher has been made sales manager of the explosives department of **Hercules Powder Co.**

Syntron Irvin Sales Co. of Indiana, Pa., has recently obtained the exclusive franchise to represent the H. J. Daniels Co., Inc., in the sale of the Daniels Dense Media System throughout the coal areas of Central Pennsylvania and portions of Maryland.

Stratoflex, Inc., manufacturers and distributors of detachable, reusable hose fittings and flexible hose assemblies, has moved into new general offices at 5255 River Oaks Boulevard in Fort Worth, Tex.

Charles L. Bend, Denver sales engineer, retired recently from **The Electric Storage Battery Co.** after more than 32 years' service.

Retirement of **A. Magnum Webb** from his post as vice-president and sales manager of **Chemical Construction Corp.** has been announced. Webb is remaining with the company as a consultant on sales and customer relations.

Hugh Glen has been elected president of **Johnston Pump Co.** of Pasadena, Calif.

Appointment of **Arch S. Abbey** as manager of the Latin-American Section, International Division, **Mine Safety Appliances Co.**, Pittsburgh, has been announced by C. M. Donahue, vice-president.

Templeton, Kenly & Co., manufacturer of Simplex Jacks, has moved into its new plant in Broadview, Ill., a suburb of Chicago.

L. G. Currie has been appointed a district sales manager by the **Marion Power Shovel Co.** He will head Marion's District 116 which covers the southern part of Indiana and Illinois and parts of Kentucky.

Election of **Arthur M. Grasse** as vice-president in charge of industrial products, **Goodman Mfg. Co.** has been announced. Grasse, associated with Goodman for 33 years in various divisions of the business, has been manager of its industrial manufacturing division.

Lawrence R. Obert has been promoted from general manager to vice-president of the **Santa Fe Tank & Tower Co.** Obert has been with Santa Fe since 1919.

CATALOGS AND BULLETINS

BABBITLESS GYRATORY CRUSHER. *Compagnie des Enterprises Industrielles, 9 Rue Boissy-d'Angals, Paris 8, France.* Bulletin NR 521 describes the primary and secondary crushers manufactured by this French firm.

CARBIDE-TIPPED MINING TOOLS. *Vascoloy-Ramet Corp., Waukegan, Ill.* Nine new styles of carbide-tipped mining tools are featured, including a complete line of Auger Drill Bits, Roof Drills, Chain Cutter Bits and Finger Bits.

FLUOSOLIDS ROASTING OF ZINC CONCENTRATES. *The Dorr Co., Barry Place, Stamford, Conn.* Covers the application of FluoSolids to the roasting of zinc concentrates. Request Bulletin No. 7501.

MINE CAR DUMPING. *Nolan Co., Bowerston, Ohio.* Describes latest developments in mine car dumping and control equipment. Has description of the three models of the Nolan Porta-Feeder, which include direct mechanical drive, hydraulic fluid drive and hydraulic cylinder drive. Free copies are available from the manufacturer.

PERFORATED METALS. *Diamond Manufacturing Co., Wyoming, Pa.* Catalog 39 illustrates and describes a complete line of round, square, oblong and ornamental perforations, ranging from .02 in. to 9.5 in. in diam. Contains other information for engineers and designers in selecting screen plates.

PORTABLE HOISTS. *Coffing Hoist Co., 800 Walter St., Danville, Ill.* A condensed full-line catalog containing illustrations, descriptions and specifications for over 100 different types and sizes of portable hoists. The 8-page catalog is available upon request from the Coffing Hoist Co. at the above address.

STANDARDS FOR MINING BELT CONVEYORS, *National Electrical Manufacturers Association, 155 East 44th St., New York 17, N. Y. 16 pages. Price $1.50.* These standards apply to sectional-type electrically driven troughed belt conveyors commonly used in mines above and below ground and to direct-current motors and three-phase 60-cycle squirrel-cage induction motors used to drive such conveyors. A section is included for electric controls, and the terms used throughout the standards are defined. The publication number is MB1-1954.

TM DORRCLONE. *The Dorr Co., Barry Place, Stamford, Conn.* Bulletin describes in detail two types of multiple-unit TM DorrClones and their applications.

THE DESIGN AND USE OF BELT CONVEYORS IN MINES, *by A. Grierson, The Mining Journal, 15 Wilson Street, Moorgate, London, E. C. 2.* This 40-page book was written primarily to fill a gap in the knowledge of conveying and conveyors in the British Isles. It is a collection of articles written for *The Mining Journal*. To those engaged in the design and manufacture of conveyors, the material in the book will be familiar. For those not conversant with modern conveyor practice the book is a mine of information.

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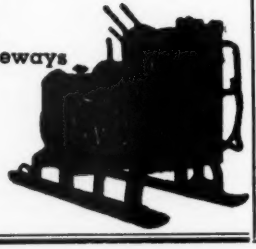

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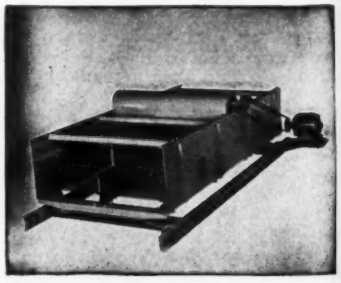

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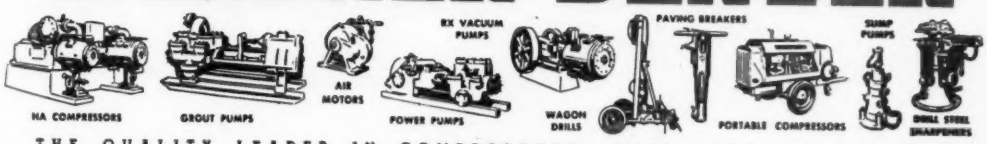

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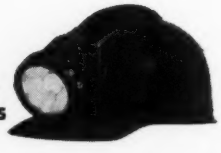

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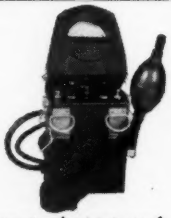

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